# MICRO-TECH®
# REFERENCE MANUAL

## Models:
## Micro-Tech 600, 1200 & 2400
## Micro-Tech 601, 1201 & 2401

Some models may be exported under the name *Amcron*.®

© 2001 by Crown Audio, Inc., P.O. Box 1000, Elkhart, IN 46515-1000 U.S.A. Telephone: 219-294-8000. Fax: 219-294-8329. Trademark Notice: *Grounded Bridge™ is a trademark and Amcron®, Crown®*, Micro-Tech and ODEP are registered trademarks of Crown International, Inc. Other trademarks are the property of their respective owners.

**Obtaining Other Language Versions:**
To obtain information in another language about the use of this product, please contact your local Crown Distributor. If you need assistance locating your local distributor, please contact Crown at 219-294-8200.

**Note:** The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred. To obtain the latest version of this manual, please visit the Crown website at www.crownaudio.com.

LUCASFILM THX® Approved for THX Theatre Systems.

A Harman International Company

102990-5
2/01

# THREE YEAR FULL WARRANTY

## WORLDWIDE

### SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown[1] product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship, and we further warrant the new Crown product regardless of the reason for failure, except as excluded in this Crown Warranty.

[1] *Note: If your unit bears the name "Amcron," please substitute it for the name "Crown" in this warranty.*

### ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

### WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers. We will remedy the defect and ship the product from the service center within a reasonable time after receipt of the defective product at our authorized service center.

### HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by our authorized service center. If the repairs made by our authorized service center are not satisfactory, notify our authorized service center immediately.

### DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

### WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

### DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

### LEGAL REMEDIES OF PURCHASER

No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

**THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.**

9/90

*Telephone: 219-294-8200. Facsimile: 219-294-8301*

## NORTH AMERICA

### SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship. We further warrant the new Crown product regardless of the reason for failure, except as excluded in this Warranty.

### ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

### WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at the factory. We will remedy the defect and ship the product from the service center or our factory within a reasonable time after receipt of the defective product at our authorized service center or our factory. All expenses in remedying the defect, including surface shipping costs in the United States, will be borne by us. (You must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

### HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack, which, if needed, may be obtained from us free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our authorized service center. If the repairs made by us or our authorized service center are not satisfactory, notify us or our authorized service center immediately.

### DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

### WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

### DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

### LEGAL REMEDIES OF PURCHASER

THIS CROWN WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

**THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.**

*Telephone: 219-294-8200. Facsimile: 219-294-8301* 9/90

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If your unit bears the name "Amcron," please substitute it for the name "Crown" in this manual. If you need special assistance beyond the scope of this manual, please contact our Technical Support Group.


**Crown Technical Support Group**

Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

Phone: **800-342-6939** (North America, Puerto Rico and Virgin Islands) or 219-294-8200

Fax: 219-294-8301 Internet: http://www.crownaudio.com


# IMPORTANT

**THE MICRO-TECH 2400/2401 REQUIRES CLASS 1 OUTPUT WIRING. THE MICRO-TECH 600/601 & 1200/ 1201 REQUIRE CLASS 2 OUTPUT WIRING.**

**CAUTION**

**RISK OF ELECTRIC SHOCK DO NOT OPEN**

**TO PREVENT ELECTRIC SHOCK DO NOT REMOVE TOP OR BOTTOM COVERS. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. DISCONNECT POWER CORD BEFORE REMOVING BACK PANEL COVER TO ACCESS GAIN SWITCH.**

**AVIS**

**RISQUE DE CHOC ÉLECTRIQUE N'OUVREZ PAS**

**À PRÉVENIR LE CHOC ÉLECTRIQUE N'ENLEVEZ PAS LES COUVERCLES. IL N'Y A PAS DES PARTIES SERVICEABLE À L'INTÉRIEUR. TOUS REPARATIONS DOIT ETRE FAIRE PAR PERSONNEL QUALIFIÉ SEULMENT. DÉBRANCHER LA BORNE AVANT D'ENLEVER LA COVERTURE EN ARRIÈRE.**

# WARNING

**TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE!**

## Magnetic Field

**CAUTION! Do not locate sensitive high-gain equipment such as preamplifiers or tape decks directly above or below the unit.** Because this amplifier has a high power density, it has a strong magnetic field which can induce hum into unshielded devices that are located nearby. The field is strongest just above and below the unit.

If an equipment rack is used, we recommend locating the amplifier(s) in the bottom of the rack and the preamplifier or other sensitive equipment at the top.

## WATCH FOR THESE SYMBOLS:

The lightning bolt triangle is used to alert the user to the risk of electric shock.

The exclamation point triangle is used to alert the user to important operating or maintenance instructions.

Printed on recycled paper.

# Important Safety Instructions

1) Read these instructions.
2) Keep these instructions.
3) Heed all warnings.
4) Follow all instructions.
5) Do not use this apparatus near water.
6) Clean only with a dry cloth.
7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10) Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.

12) Use only with a cart, stand, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13) Unplug this apparatus during lightning storms or when unused for long periods of time.
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15) To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

# CONTENTS

**1 Welcome ..... 7**
1.1 Unpacking ..... 7
1.2 Features ..... 7

**2 Facilities ..... 8**

**3 Installation ..... 10**
3.1 Mounting ..... 10
3.2 Cooling ..... 10
3.3 Wiring ..... 11
3.3.1 Stereo (Two-Channel) Operation ..... 11
3.3.2 Bridge-Mono Operation ..... 12
3.3.3 Parallel-Mono Operation ..... 13
3.3.4 Input Connection ..... 14
3.3.5 Output Connection ..... 16
3.3.6 Additional Load Protection ..... 18
3.4 AC Mains Power Requirements ..... 18

**4 Operation ..... 19**
4.1 Precautions ..... 19
4.2 Indicators ..... 19
4.3 Protection Systems ..... 19
4.3.1 *ODEP* ..... 19
4.3.2 Ultrasonic and Radio Frequency Protection ..... 20
4.3.3 Drive Protection ..... 20
4.3.4 Transformer Thermal Protection ..... 20
4.3.5 Fuses and Circuit Breakers ..... 20
4.4 Controls ..... 21
4.5 Filter Cleaning ..... 21

**5 Technical Information ..... 22**
5.1 Overview ..... 22
5.2 Circuit Theory ..... 22
5.2.1 Stereo Operation ..... 22
5.2.2 Bridge-Mono Operation ..... 24
5.2.3 Parallel-Mono Operation ..... 24

**6 Specifications ..... 25**

**7 AC Power Draw and Thermal Dissipation ..... 34**

**8 Accessories ..... 36**
8.1 Cooling Fan Options ..... 36
8.2 Input Connectors ..... 36
8.2.1 *MT-XLR* ..... 36
8.2.2 *MT-BB* ..... 36

**9 Service ..... 37**
9.1 Worldwide Service ..... 37
9.2 North American Service ..... 37
9.2.1 Service at a North American Service Center ..... 37
9.2.2 Factory Service ..... 37

# ILLUSTRATIONS


1.1 *Micro-Tech* Amplifier ..... 7
2.1 Front Facilities ..... 8
2.2 Rear Facilities ..... 9
3.1 Mounting Dimensions ..... 10
3.2 Top View of a Rack-Mounted Unit ..... 10
3.3 Proper Air Flow with a Rack-Mounted Blower ..... 10
3.4 Stereo Wiring ..... 11
3.5 Bridge-Mono Wiring ..... 12
3.6 Parallel-Mono Wiring ..... 13
3.7 Unbalanced Input Wiring for the Optional *MT-XLR* ..... 14
3.8 Balanced Input Wiring for the Optional *MT-XLR* ..... 14
3.9 Balanced and Unbalanced Phone Plug Wiring ..... 14
3.10 Subsonic Filter Capacitors ..... 15
3.11 Unbalanced RF Filters ..... 15
3.12 Balanced RF Filters ..... 15
3.13 Wire Size Nomograph ..... 16
3.14 Low-Frequency Protection Circuit for Inductive Loads ..... 17
3.15 Loudspeaker Fuse Nomograph ..... 18
3.16 AC Mains Cords and Plugs ..... 18
4.1 Indicators ..... 19
4.2 Input Sensitivity and Ground Lift Switches ..... 21
5.1 Circuit Block Diagram ..... 23
6.1 *Micro-Tech 600* Minimum Power Matrix ..... 27
6.2 *Micro-Tech 1200* Minimum Power Matrix ..... 28
6.3 *Micro-Tech 2400* Minimum Power Matrix ..... 28
6.4 *Micro-Tech 600* Maximum Power Matrix ..... 29
6.5 *Micro-Tech 1200* Maximum Power Matrix ..... 30
6.6 *Micro-Tech 2400* Maximum Power Matrix ..... 30
6.7 Typical Frequency Response ..... 31
6.8 Typical Damping Factor ..... 31
6.9 Typical Output Impedance ..... 31
6.10 Typical Phase Response ..... 32
6.11 Typical Crosstalk for the *Micro-Tech 600* ..... 32
6.12 Typical Crosstalk for the *Micro-Tech 1200* ..... 33
6.13 Typical Crosstalk for the *Micro-Tech 2400* ..... 33
7.1 *Micro-Tech 600* Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles ..... 34
7.2 *Micro-Tech 1200* Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles ..... 35
7.3 *Micro-Tech 2400* Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles ..... 35
8.1 *MT-XLR* ..... 36
8.2 *MT-BB* ..... 36

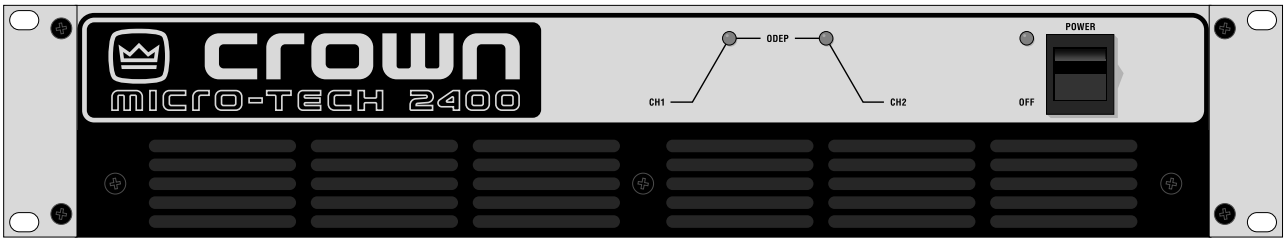
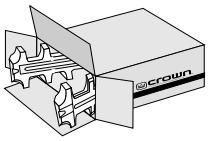



*Fig. 1.1 Micro-Tech Amplifier*

# 1 Welcome

Congratulations on your purchase of a *Micro-Tech*® professional power amplifier. Crown's *Micro-Tech 600*, *1200* and *2400* are the original industry standards for touring amplifiers. *Micro-Tech* amplifiers are known around the world as a the benchmark for high-density, ultra-pure power in a compact, lightweight package. In addition, each model gives you Crown's legendary *ODEP*® protection to keep the show going long after other amplifiers would fail.

This manual will help you successfully install and use your new amplifier—we strongly recommend you read all instructions, warnings and cautions. Be sure to read Sections 3.3.2 and 3.3.3 if you plan to use the amplifier in one of its two mono modes. Also for your protection, please send in your warranty registration card today and save your bill of sale since it is your **official proof of purchase**.



## 1.1 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim for shipping damage. Crown will be happy to cooperate fully as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, as most do, save all packing materials so you will have them if you ever need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

## 1.2 Features

*Micro-Tech* amplifiers use the latest technology and miniaturized design to deliver the highest power and value for their size, weight and price. Crown's patented *ODEP* protection circuitry *and Grounded Bridge*™ output stages combine to provide performance and reli-ability that surpass all traditional designs. *Micro-Tech* amplifiers also have an independent high-voltage power supply for each channel. This approach results in extremely low crosstalk and makes it possible to use each channel as a separate amplifier. Here are some more impressive features of your *Micro-Tech* amplifier:

- ❏ Patented *ODEP* (Output Device Emulation Protection) circuitry compensates for overheating and overload to keep the amplifier working long after others would fail.
- ❏ Crown's *Grounded Bridge*™ design delivers incredible voltage swings without using stressful output transistor configurations like more traditional amplifiers. This results in significantly lower distortion and superior reliability.
- ❏ Very low harmonic and intermodulation distortion result in the best *dynamic transfer function* in the industry.
- ❏ High damping factor provides superior motion control over low-frequency drivers for clean, accurate low end.
- ❏ Two mono modes (Bridge-Mono and Parallel-Mono) for driving a wide range of load impedances.
- ❏ Full protection against shorted outputs, open circuits, DC, mismatched loads, general overheating, high-frequency overloads and internal faults.
- ❏ Efficient heat sinks and self-contained forced air cooling prevent overheating and prolong component life.
- ❏ Ground lift switch to isolate chassis and phone jack audio grounds.
- ❏ Binding post outputs provide easy and versatile output connection.
- ❏ Internal three-position input sensitivity switch provides settings of 0.775 and 1.4 volts for standard 1-kHz power, and 26-dB voltage gain.
- ❏ Mounts in a standard 19-inch (48.3-cm) equipment rack (units can also be stacked).
- ❏ Three year "No-Fault" full warranty completely protects your investment and guarantees its specifications.

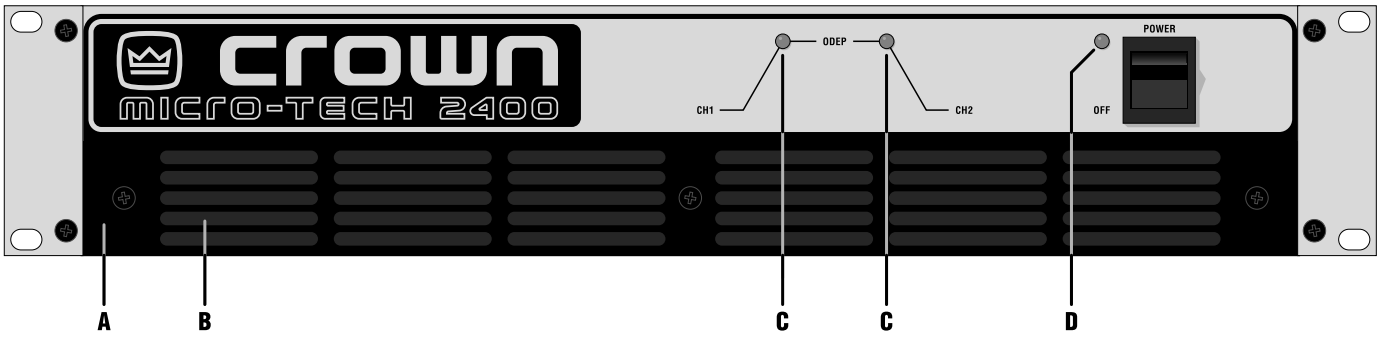



*Fig. 2.1 Front Facilities*

# 2 Facilities

## A. Filter Grille

This metal grille supports and protects the dust filter (B). To clean the dust filter, detach the grille by removing the three screws that hold it in place.

## B. Dust Filter

The dust filter removes large particles from the air drawn by the cooling fan. Check the filter regularly to prevent clogging (see Sections 3.2 and 4.5).

## C. *ODEP* Indicators

During normal operation of the Output Device Emulation Protection circuitry, these amber indicators glow brightly to show that reserve thermodynamic energy is present. They dim proportionally as energy reserves decrease. In the rare event that energy reserves are depleted, the *ODEP* indicators turn off and the protection circuitry proportionally limits output drive so the amplifier can safely continue operating even under severe conditions. These indicators also help identify more unusual operating conditions (see Section 4.2).

## D. Enable Indicator

This indicator lights when the amplifier has been turned on, AC power is available and the low-voltage power supply and fan are operational (see Section 4.2).

## E. Power Switch

This rocker switch is used to turn the amplifier on and off. When turned on, the output is muted for approximately four seconds to protect your system from start-up transients. (To change the start-up delay time, contact Crown's Technical Support Group.)

## F. Power Cord

All units are shipped with an appropriate plug and cord for the required AC voltage (see Figure 3.16). Also, refer to Section 7 for power usage information.

## G. Stereo/Mono Modes Switch

The three operating modes of a *Micro-Tech* amplifier are controlled by this three-way switch. Stereo mode is used for normal two-channel operation, Bridge-Mono mode is used to drive a single channel with a load impedance of at least 4 ohms, and Parallel-Mono mode is used to drive a single channel with a load impedance less than 4 ohms. **Important: Turn off the amplifier before changing the stereo/mono modes switch (see Section 3.3).**

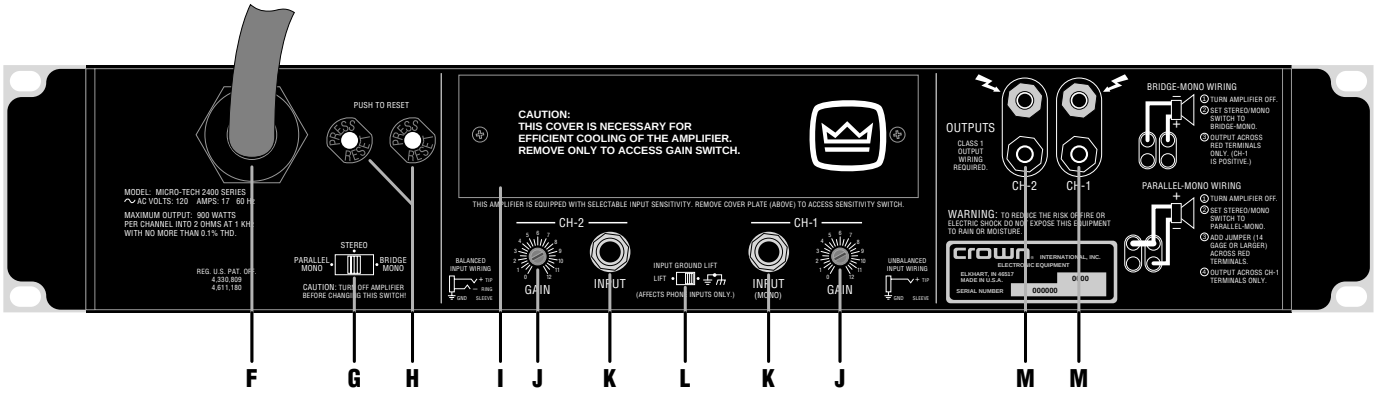



*Fig. 2.2 Rear Facilities*

## H. Reset Switches (*Micro-Tech 2400* only)

The *Micro-Tech 2400* has two push-button reset switches on the back panel that are used to reset the circuit breakers for the high-voltage power supplies.

## I. Cover Plate

This cover plate is removed when changing the amplifier's input sensitivity (see Section 4.4) or installing an *MT-XLR* or *MT-BB* accessory (see Section 8.2).

## ❑ Input Sensitivity Switch

The three-position input sensitivity switch is located inside the amplifier behind the cover plate (I). Settings include 0.775 volts and 1.4 volts for standard 1 kHz power, and 26 dB gain (see Section 4.4).

## J. Level Controls

These back panel level controls are used to set the amplifier's output levels (see Section 4.4). Be sure to turn down the channel 2 level control (fully counterclockwise) when operating in Bridge-Mono mode.

## K. Balanced Phone Jack Inputs

A balanced ¼-inch phone jack input is provided for each channel. They may be wired for either balanced (tip, ring and sleeve) or unbalanced (tip and sleeve) operation (refer to Section 3.3.4). XLR and barrier block input connectors are available with the *MT-XLR* and *MT-BB* accessories (see Section 8.2). **Caution: Do <u>not</u> use the channel 2 input in either mono mode.**

## L. Ground Lift Switch

This switch is used to isolate the phone jack signal grounds from the AC power (chassis) ground. Moving the switch to the "lift" position helps prevent the hum associated with ground loops (see Section 4.4).

## M. Output Jacks

A pair of versatile binding posts is provided for output connection to each channel. Loudspeakers can be easily connected using banana plugs, spade lugs or bare wire (European models do <u>not</u> accept banana plugs). See Section 3.3.

# 3 Installation

## 3.1 Mounting

*Micro-Tech* amplifiers are designed for standard 19-inch (48.3-cm) rack mounting or stacking without a cabinet. In a rack, it is best to mount units directly on top of each other. This provides the most efficient air flow and support. If the rack will be transported, we recommend that you provide support for the amplifier's back panel or secure it to the rack to help support the unit's weight.

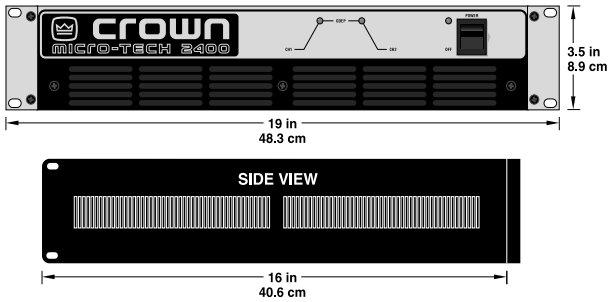



*Fig. 3.1 Mounting Dimensions*

## 3.2 Cooling

*Micro-Tech* amplifiers include an internal fan that runs when the unit is turned on. Before mounting your amplifier, you should familiarize yourself with its cooling requirements.

Here are some tips to help keep your amplifier cool. First, never block the amplifier's front or side air vents. If the amplifier is rack-mounted, its sides should be at least 2 inches (5 cm) away from the cabinet (see Figure 3.2). Also, open spaces in the rack should be covered to prevent heated air from the side exhaust vents from being drawn into the front air intake.

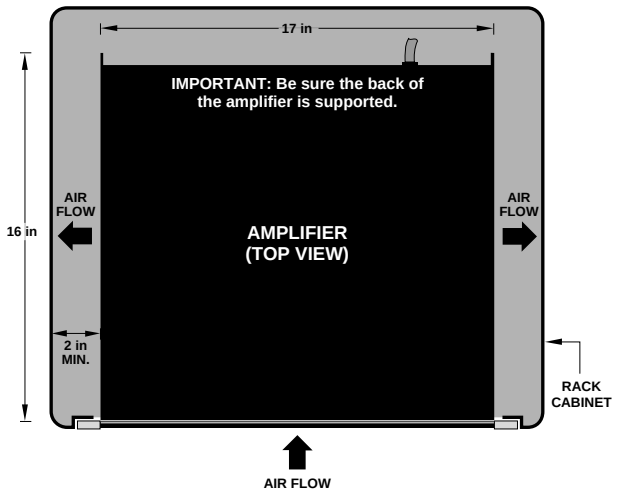



*Fig. 3.2 Top View of a Rack-Mounted Unit*

You will know when your *Micro-Tech* amplifier has sufficient cooling because its *ODEP* indicators will be brightly lit. If the amplifier's *ODEP* indicators dim or turn off, overly demanding conditions are forcing it to protect itself from overheating. If you experience a cooling problem, you should consider several factors that may be contributing to the problem, including load impedance, air flow and ambient air temperature.

Low-impedance loads generate more heat than higher impedance loads. To avoid impedance-related cooling problems, connect loads to each channel with a total impedance of at least 2 ohms in Stereo, 4 ohms in Bridge-Mono, and 1 ohm in Parallel-Mono mode (see Section 3.3 for wiring instructions). If your loads are reasonable and you still have a cooling problem, check for shorts in the loudspeaker cables, and look for problems with air flow or ambient air temperature.

Air flow restrictions are the most common cause of inadequate cooling. Restrictions may result from improper mounting, piles of power cords, clogged dust filters and closed rack doors. Mount the amplifier to allow sufficient air flow into the front intake, out the side exhaust vents, and out the back of the rack. An air flow restriction like a pile of power cords can simply be moved out of the way. Air filters should be cleaned using the procedure in Section 4.5. If rack doors are the problem, you can leave them open, remove them, or install a grille. If you install a grille, we recommend using a wire grille because perforated panels restrict air flow by at least 40%.

If your *ODEP* indicators still dim under demanding conditions, you may want to install supplemental cooling like a rack-mounted blower or an air conditioner. A "squirrel cage" blower can be installed at the bottom of

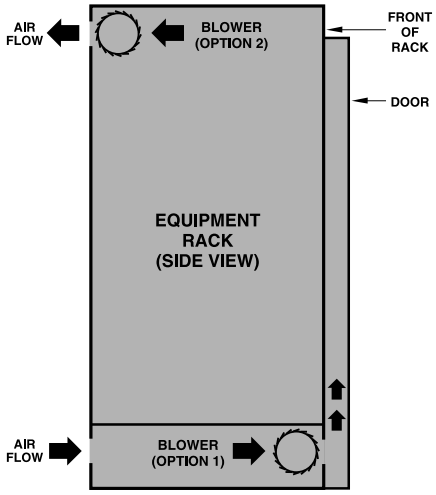



*Fig. 3.3 Proper Air Flow with a Rack-Mounted Blower*

the rack so it blows outside air into the space between the door and the front of the amplifiers. This will pressurize the "chimney" behind the door (Figure 3.3, Option 1). The blower should not blow air into or take air out of the space behind the amplifiers. For racks without a front door, you can evacuate the rack by mounting the blower at the top of the rack so air blows out the back (Figure 3.3, Option 2). You can estimate a rack's required air flow by adding each unit's maximum air flow rating. Each *Micro-Tech 600* and *1200* can move 35 cubic feet (1 cubic meter) of air per minute, and each *Micro-Tech 2400* can move 45 cubic feet (1.3 cubic meters) of air per minute. So if you put one of each in a rack, you would need 115 cubic feet (3.2 cubic meters) of air flow through the rack per minute under worst-case conditions (35 cubic feet + 35 cubic feet + 45 cubic feet = 115 cubic feet).

Another cooling problem to consider is high ambient air temperature. If the ambient air temperature is extremely high, *ODEP* may reduce the output to protect the amplifier even when it is receiving the maximum recommended air flow. Under these unusual conditions, it may be necessary to use air conditioning for supplemental cooling. Air conditioning is rarely a necessity because internal fans and rack-mounted blowers almost always provide enough air flow for the most extreme conditions. Still, air conditioning helps reduce the ambient temperature of the air flowing through the rack. If you plan to use air conditioning, refer to Section 7 for information on calculating the hourly thermal dissipation of your system.

## 3.3 Wiring

The following section describes common ways to install your amplifier in a sound system. The input and output terminals are located on the back panel. Please use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own! Crown assumes no liability for damaged loads resulting from careless amplifier use or deliberate overpowering.

**CAUTION: When making or changing connections, always disconnect the AC power and turn the level controls off (fully counterclockwise).** This is very important because it reduces the chance of loud blasts that can cause loudspeaker damage.

*Micro-Tech* amplifiers may be operated in one of three modes (Stereo, Bridge-Mono and Parallel-Mono) by switching the stereo/mono switch on the back panel. There are VERY IMPORTANT wiring differences among these three modes which are discussed next.

### 3.3.1 Stereo (Two-Channel) Operation

In Stereo mode, installation is very intuitive: input channel 1 feeds output channel 1, and input channel 2 feeds output channel 2. To put the amplifier into Stereo mode, first turn the amplifier off, then slide the stereo/mono switch to the center position, and properly connect the output wiring as shown in Figure 3.4. Each channel has a pair of binding posts for easy loudspeaker cable connection. Observe correct polarity, and be very careful not to short the two channels together.

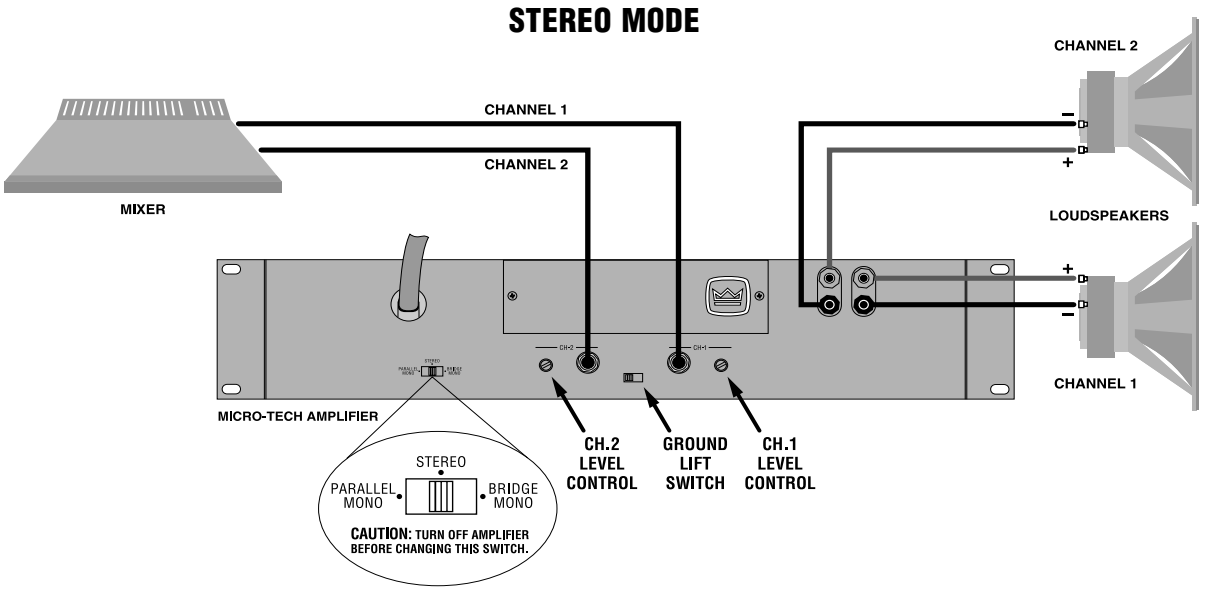



*Fig. 3.4 Stereo Wiring*

**CAUTION: In Stereo mode, never tie the amplifier's outputs directly together, and never parallel them with the output of another amplifier.** Such connections do not increase the output power and may activate the protection circuitry to prevent overheating.

### 3.3.2 Bridge-Mono Operation

Bridge-Mono mode is used to drive loads with a total impedance of at least 4 ohms (see Section 3.3.3 if the load is less than 4 ohms). Wiring for Bridge-Mono mode is very different from the other modes and requires special attention. First, turn off the amplifier. Then select Bridge-Mono mode by sliding the stereo/mono switch to the right (as you face the back panel). Both outputs receive the channel 1 input signal, but channel 2 is inverted so it can be bridged with channel 1. DO NOT USE THE CHANNEL 2 INPUT or signal quality will be greatly degraded. Also, turn down the channel 2 level control (fully counterclockwise).

*Note: The channel 2 input and level control are not defeated in Bridge-Mono mode. Any signal feeding channel 2 will work against the channel 1 signal, and usually results in distortion and inefficient operation.*

Connect the load across the two red (+) binding posts as shown in Figure 3.5. The positive (+) lead from the loudspeaker connects to the red (+) channel 1 binding post, and the negative (–) or ground lead from the loudspeaker connects to the red (+) channel 2 binding post. Do not connect the black (–) binding posts. Also, the load must be balanced so neither lead is connected to ground.

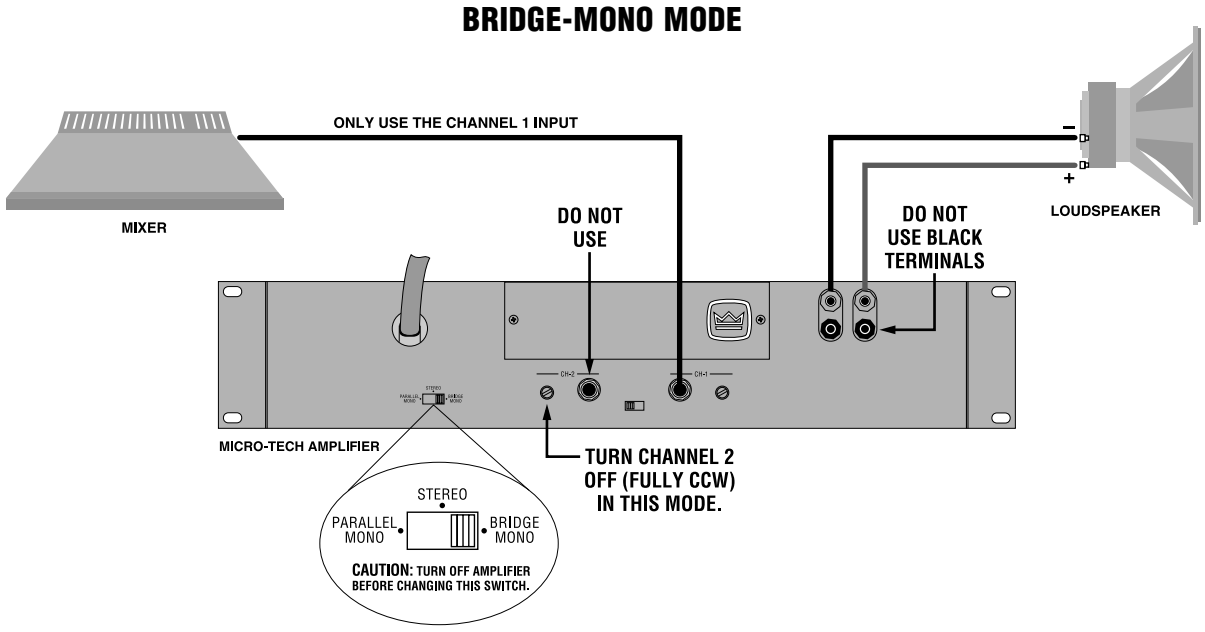



*Fig. 3.5 Bridge-Mono Wiring*

**CAUTION: Only connect balanced equipment (meters, switches, etc.) to the Bridge-Mono output. Both sides of the line must be isolated from the input grounds or oscillations may occur.**

### 3.3.3 Parallel-Mono Operation

Parallel-Mono mode is used to drive loads with a total impedance of less than 4 ohms (see Section 3.3.2 if the load is 4 ohms or more). Installing the amplifier in Parallel-Mono mode is very different from the other modes and requires special attention.

To select Parallel-Mono mode, turn off the amplifier and slide the stereo/mono switch to the left (as you face the back panel). Connect the input signal to channel 1 only. The channel 2 input and level control are bypassed in this mode, so they should not be used.

Connect the load to the channel 1 output as shown in Figure 3.6. The positive loudspeaker lead (+) connects to the red (+) channel 1 binding post and the negative (–) or ground lead from the loudspeaker connects to the black (–) channel 1 binding post. Finally, install a jumper wire of at least 14 gauge between the red (+) binding posts of both channels 1 and 2.

**CAUTION: When wired for Parallel-Mono mode, do not operate the amplifier in Stereo or Bridge-Mono mode until the output wiring is reconfigured. Failure to do so will result in inefficient operation, high distortion and excessive heating.**

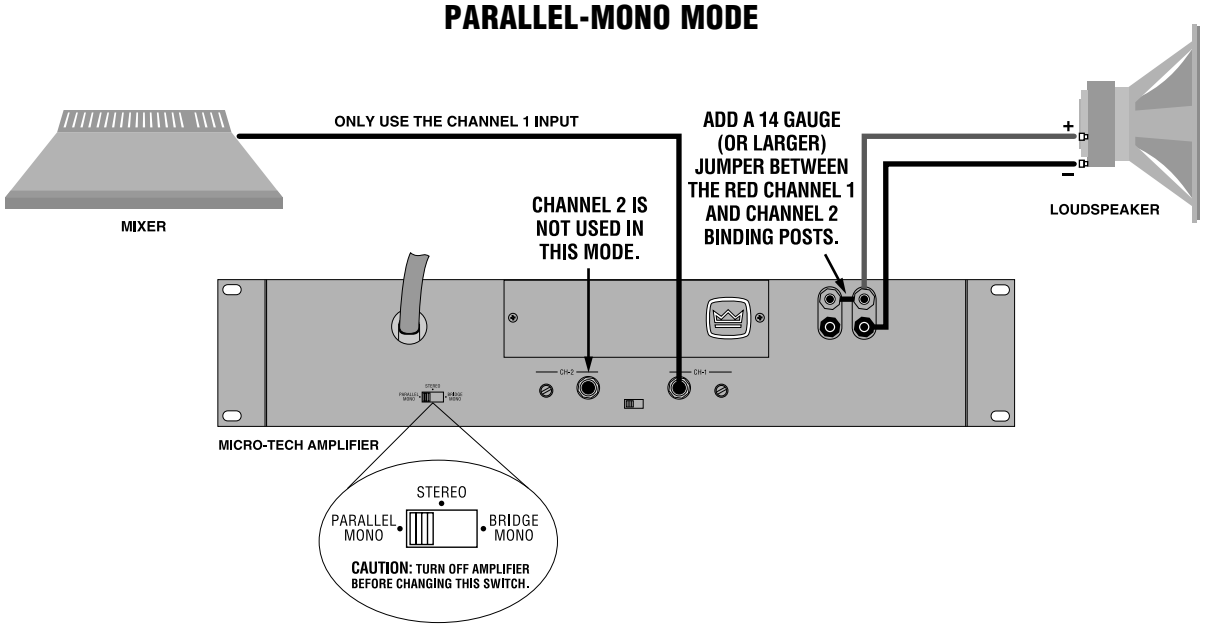

PARALLEL-MONO MODE
ONLY USE THE CHANNEL 1 INPUT
ADD A 14 GAUGE (OR LARGER) JUMPER BETWEEN THE RED CHANNEL 1 AND CHANNEL 2 BINDING POSTS.
+
–
LOUDSPEAKER
MIXER
CHANNEL 2 IS NOT USED IN THIS MODE.
MICRO-TECH AMPLIFIER
STEREO
PARALLEL MONO
BRIDGE MONO
CAUTION: TURN OFF AMPLIFIER BEFORE CHANGING THIS SWITCH.

*Fig. 3.6 Parallel-Mono Wiring*

### 3.3.4 Input Connection

The balanced phone jack inputs have a nominal impedance of 20 K ohms (10 K ohms with unbalanced wiring) and will accept the line-level output of most devices. Three-pin female XLR connectors are also available on the optional *MT-XLR* accessory and balanced barrier block connectors are available on the optional *MT-BB* accessory (see Section 8.2). Correct input wiring will depend on two factors: (1) whether the input signals are balanced or unbalanced, and (2) whether the signal source floats or has a ground reference. Figures 3.7 and 3.8 provide examples of recommended connection techniques for each type of signal source. The optional *MT-XLR* connector is shown.

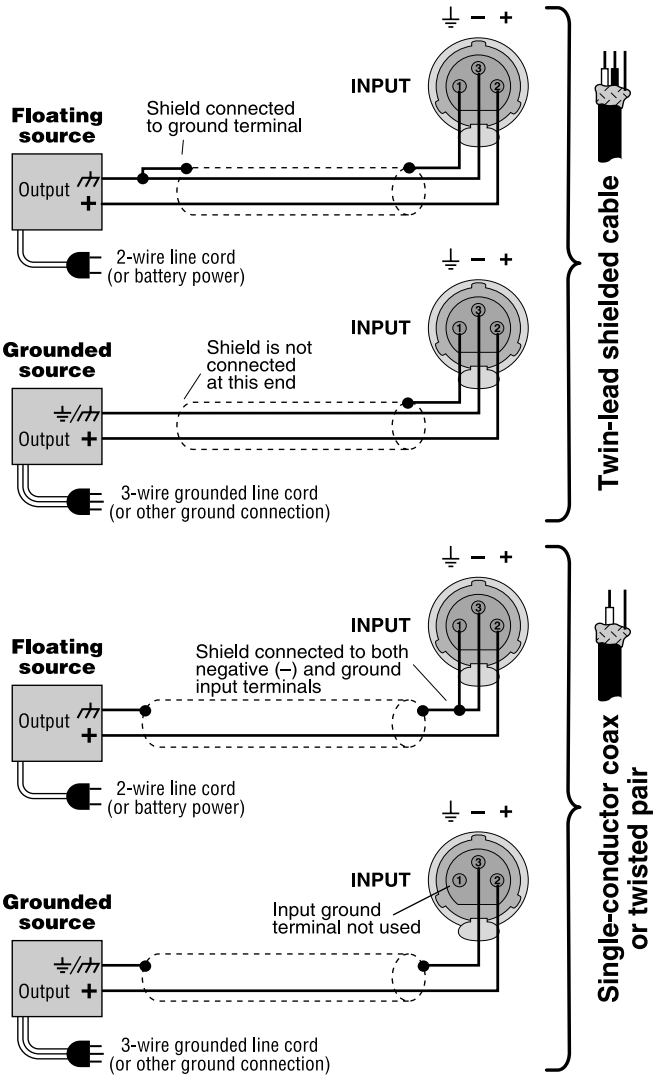

Floating source
Shield connected to ground terminal
INPUT
Output
2-wire line cord (or battery power)
Grounded source
Shield is not connected at this end
3-wire grounded line cord (or other ground connection)
Twin-lead shielded cable
Floating source
Shield connected to both negative (–) and ground input terminals
Grounded source
Input ground terminal not used
Single-conductor coax or twisted pair

*Fig. 3.7 Unbalanced Input Wiring for the Optional MT-XLR*

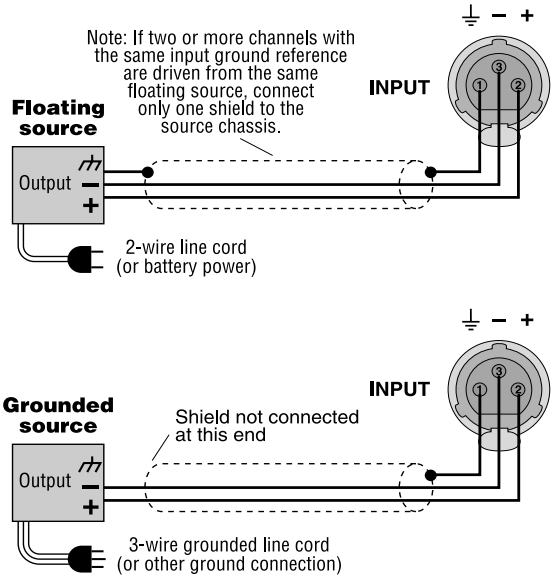

Note: If two or more channels with the same input ground reference are driven from the same floating source, connect only one shield to the source chassis.
Floating source
INPUT
Output
2-wire line cord (or battery power)
Grounded source
Shield not connected at this end
3-wire grounded line cord (or other ground connection)

*Fig. 3.8 Balanced Input Wiring for the Optional MT-XLR*

The amplifier's built-in ¼-inch input phone connectors can be wired similarly for balanced or unbalanced, floating or ground-referenced sources. The phone connectors have a standard tip-ring-sleeve (TRS) configuration: the tip is positive (+), ring is negative (–) and sleeve is ground (see Figure 3.9). Wiring for different sources follows the XLR wiring guidelines shown in Figures 3.7 and 3.8.

When either of the input connector accessories is installed, the unused input connectors can be used as "daisy chain" outputs to feed the input signal from one amplifier to another.

Please follow the input wiring instructions in Section 3.3.2 and 3.3.3 if the amplifier will be used in either Bridge-Mono or Parallel-Mono mode. Remember, do not use the channel 2 input in either mono mode.

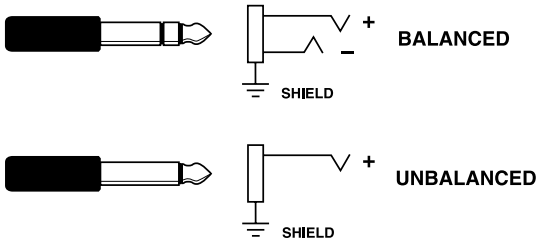



*Fig. 3.9 Balanced and Unbalanced Phone Plug Wiring*

## SOLVING INPUT PROBLEMS

Sometimes large **subsonic** (subaudible) **frequencies** are present in the input signal. These can damage loudspeakers by overloading or overheating them. To attenuate such frequencies, place a capacitor in series with the input signal line. The graph in Figure 3.10 shows some possible capacitor values and how they affect frequency response. Use only low-leakage paper, mylar or tantalum capacitors.

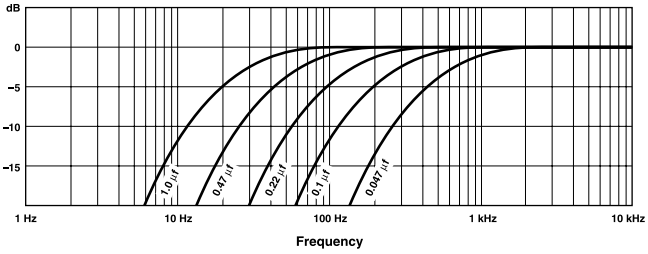



*Fig. 3.10 Subsonic Filter Capacitors*

Another problem to avoid is the presence of large levels of **radio frequencies** or RF in the input signal. Although high RF levels may not pose a threat to the amplifier, they can burn out tweeters or other loads that are sensitive to high frequencies. Extremely high RF levels may also cause the amplifier to prematurely activate its protection circuitry. RF can be introduced into an input signal by local radio stations or the bias signal of many tape recorders. To prevent RF problems, install appropriate low-pass filters on the inputs. Examples are shown below for unbalanced wiring:

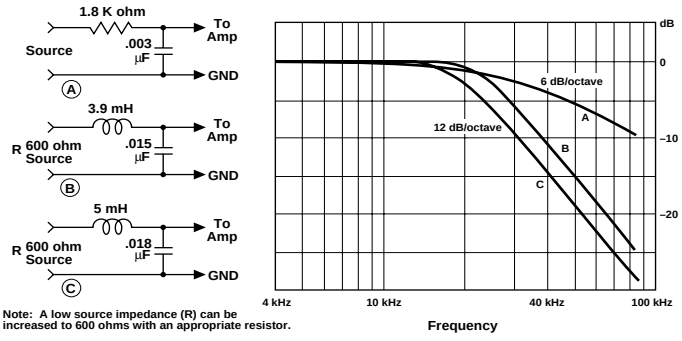



*Fig. 3.11 Unbalanced RF Filters*

For balanced input wiring, use one of the examples in Figure 3.12. Filters A, B and C correspond to the unbalanced filters above. Filter D also incorporates the subsonic filter described previously.

Another problem to avoid is **ground loops.** These are undesired currents that flow in a grounded system and

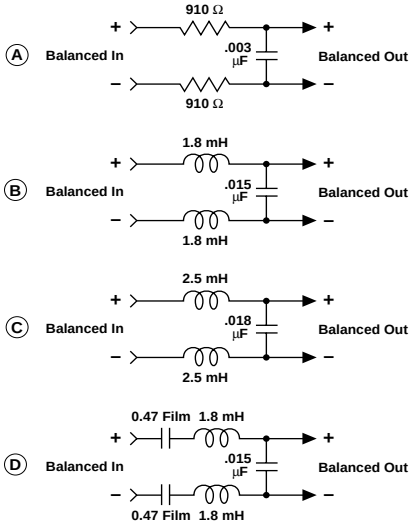



*Fig. 3.12 Balanced RF Filters*

usually cause hum in the output. A common source of ground loop problems is the placement of input cables parallel to power cables or near power transformers. The magnetic field that surrounds these conductors can induce the 50 or 60 Hz alternating current into your input cables. To prevent this type of ground loop, it is always a good idea to locate input cables away from power cables and power transformers. We also recommend using shielded or twisted pair wire. With loose wires, use tie-wraps to bundle together each pair of input wires. This helps reduce magnetically-induced cur-

### Input Wiring Tips

1. Use only shielded cable. Cables with higher density shields are better. Spiral wrapped shield is not recommended.

2. When using unbalanced lines, keep the cables as short as possible. Avoid cable lengths greater than 10 feet (3 meters).

3. Do not run signal cables together with high-level wiring such as loudspeaker wires or AC cords. This reduces the chance of hum or noise being induced into the input cables.

4. Turn off the entire system before changing connections. Turn down the level controls (fully counterclockwise) before powering the system back up. Crown is not liable for damage incurred when any transducer or component is overdriven.

rent by minimizing the cross-sectional area between conductors that could bisect the magnetic field.

Ground loops will also occur when the input and output grounds are tied together. DO NOT CONNECT THE INPUT AND OUTPUT GROUNDS TOGETHER. Tying the input and output grounds together can also cause **feedback oscillation** from the load current flowing in the loop. To avoid this problem use proper grounding, isolate the inputs, and isolate other common AC devices. If necessary, the input phone jack grounds can be isolated from the AC mains (chassis) ground with the ground lift switch located on the back panel of the amplifier (see Figure 2.2 and Section 4.4).

### 3.3.5 Output Connection

Consider the power-handling capacity of your load before connecting it to the amplifier. Crown is not liable for damage incurred at any time due to any load being overpowered. The use of loudspeaker protection fuses is highly recommended (see Section 3.3.6). Also, please pay close attention to the precautions in Section 4.1.

#### Use Good Connectors

1. To prevent possible short circuits, insulate exposed loudspeaker cable connectors.

2. Do not use connectors that might accidentally tie conductors together when making or breaking connections (for example, a standard three-wire stereo phone plug).

3. Never use connectors that can be plugged into AC power receptacles.

4. Avoid using connectors with low current-carrying capacity.

5. Do not use connectors that have any tendency to short.

HOW TO DETERMINE
APPROPRIATE WIRE GAUGE

It is important to use loudspeaker cables with sufficient gauge (thickness) for the length being used. The resistance introduced by inadequate cables will reduce both the output power and the motion control of the loudspeakers. The latter problem occurs because the damping factor decreases as cable resistance increases. This is very important because the amplifier's excellent damping factor can easily be negated by using insufficient loudspeaker cables.

Use the nomograph and the procedure that follow to find the recommended American Wire Gauge (AWG) or resistance per 1000 feet of wire for your system.

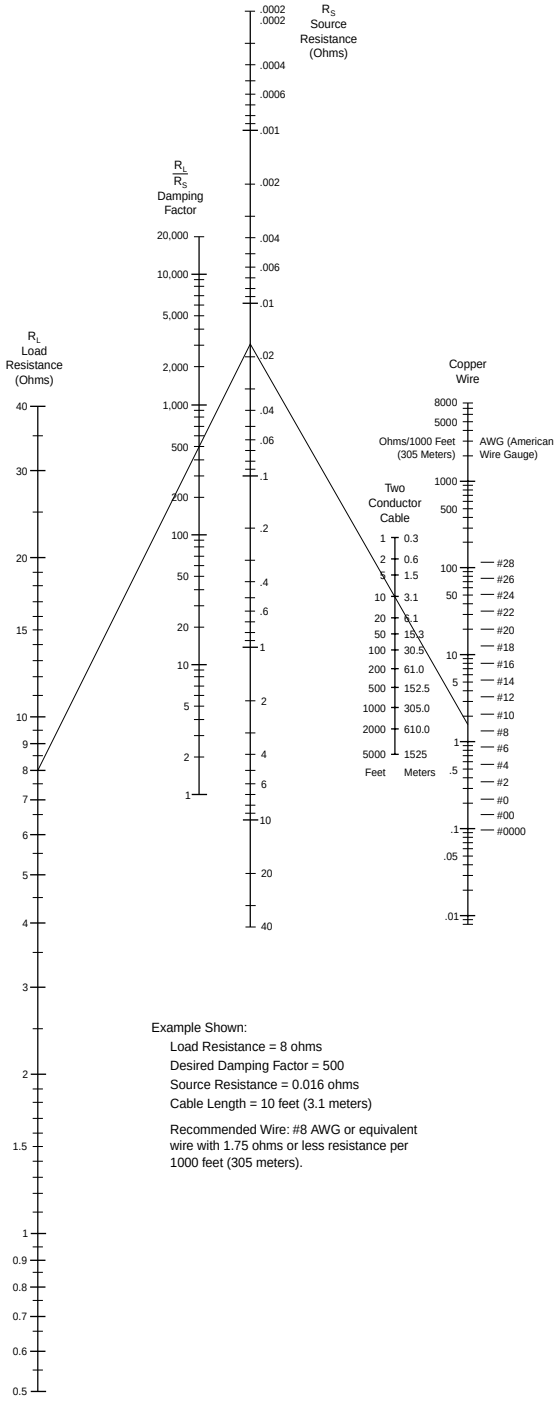

$R_L$ Load Resistance (Ohms)
$\frac{R_L}{R_S}$ Damping Factor
$R_S$ Source Resistance (Ohms)
Two Conductor Cable
Ohms/1000 Feet (305 Meters)
Feet
Meters
Copper Wire
AWG (American Wire Gauge)
Example Shown:
Load Resistance = 8 ohms
Desired Damping Factor = 500
Source Resistance = 0.016 ohms
Cable Length = 10 feet (3.1 meters)
Recommended Wire: #8 AWG or equivalent wire with 1.75 ohms or less resistance per 1000 feet (305 meters).

*Fig. 3.13 Wire Size Nomograph*

1. Note the load resistance of the loudspeakers connected to each channel of the amplifier. Mark this value on the "Load Resistance" line of the nomograph.

2. Select an acceptable damping factor and mark it on the "Damping Factor" line. Your amplifier can provide an excellent damping factor of 1,000 from 10 to 400 Hz in Stereo mode with an 8 ohm load. In contrast, typical damping factors are 50 or lower at these frequencies. Higher damping factors yield lower distortion and greater motion control over the loudspeakers. A common damping factor for commercial applications is between 50 and 100. Higher damping factors may be desirable for live sound, but long cable lengths often limit the highest damping factor that can be achieved practically. In recording studios and home hi-fi, a damping factor of 500 or more is very desirable.

3. Draw a line through the two points with a pencil, and continue until it intersects the "Source Resistance" line.

4. On the "Two Conductor Cable" line, mark the length of the cable run.

5. Draw a pencil line from the mark on the "Source Resistance" line through the mark on the "Two Conductor Cable" line and intersect the "Copper Wire" line.

6. The required wire gauge for the selected wire length and damping factor is the value on the right-hand scale of the "Copper Wire" line. For metric wire sizes, find the recommended resistance in ohms per 305 meters (1000 feet) and use this information to reference the correct wire size. *Note: Wire size increases as the AWG gets smaller*.

7. If the size of the cable exceeds what you want to use, (1) find a way to use shorter cables, (2) settle for a lower damping factor, or (3) use more than one cable for each line. Options 1 and 2 will require the substitution of new values for cable length or damping factor in the nomograph. For option 3, doubling the number of conductors of equal thickness will reduce the resistance in ohms per 1000 feet (305 meters) by half. When using AWG standards, you can estimate the effective wire gauge by subtracting 3 from the given wire gauge every time the number of conductors of equal gauge is doubled. So, if #10 wire is too large, two #13 wires can be substituted, or four #16 wires can be used for the same effect.

## SOLVING OUTPUT PROBLEMS

**High-frequency oscillations** can cause your amplifier to prematurely activate its protection circuitry. The effects of this problem are similar to the effects of the RF problems described in Section 3.3.4. To prevent high-frequency oscillations, follow these guidelines:

1. When using long cable runs, or when different amplifiers share a common cable tray or jacket, use tie-wraps to bundle individual conductors so the wires for each loudspeaker are kept close together. Do not bundle wires from different amplifiers. This reduces the chance of conductors acting like antennas that transmit or receive the high frequencies that can cause oscillations.
2. Avoid using shielded loudspeaker cable.
3. Never tie together input and output grounds.
4. Never tie together different amplifier outputs.
5. Keep output cables separated from input cables.
6. Install an RF filter in series with each input (see Section 3.3.4).
7. Install input wiring according to the instructions in Section 3.3.4.

Another problem to avoid is the presence of **large subsonic currents** when primarily inductive loads are used. Examples of inductive loads are 70-volt step-up transformers and electrostatic loudspeakers.

Inductive loads can act like a short circuit at low frequencies. This can cause the amplifier to produce large low-frequency currents and activate its protection circuitry. Always take the precaution of installing a subsonic filter in series with each of the amplifier's inputs when inductive loads are used. A three-pole, 18 dB per octave filter with a –3 dB frequency of 50 Hz is recommended (some applications may benefit from an even higher –3 dB frequency). Such a filter is described with the subsonic frequency problems in Section 3.3.4.

Another way to protect inductive loads from large low-frequency currents and to prevent the amplifier from prematurely activating its protective systems is to parallel a 590 to 708 μF nonpolarized motor start capacitor and a 4-ohm, 20-watt resistor in series with the amplifier's output and the positive (+) lead of the transformer. This circuit is shown in Figure 3.14. It uses components that are available from most electrical supply stores.

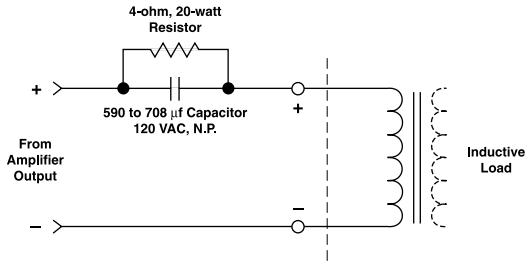



*Fig. 3.14 Low-Frequency Protection Circuit for Inductive Loads*

### 3.3.6 Additional Load Protection

*Micro-Tech* amplifiers can deliver very high power levels, so it's a good idea to add some protection if its not already built into your loudspeakers. Loudpseakers are subject to thermal damage from sustained overpowering and mechanical damage from large transient voltages. In both cases, fuses may be used to protect your loudspeakers.

Thermal protection and voltage protection require different types of fuses. Slow-blow fuses are used to prevent thermal damage because they respond to thermal conditions like a loudspeaker. High-speed instrument fuses like the Littlefuse 361000 series are used to protect loudspeakers from transient voltages. The nomograph in Figure 3.15 can be used to select the correct fuse for thermal or voltage protection.

There are two common ways to install the fuses. One approach is to put a single fuse in series with each output. This is easy because there is only one fuse per channel to install. But if the fuse blows, power is removed from all of the connected loads.

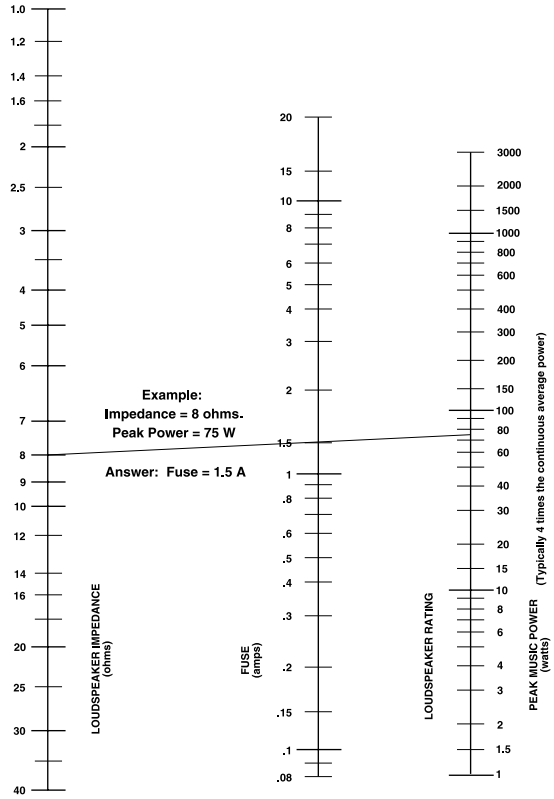



*Fig. 3.15 Loudspeaker Fuse Nomograph*

A better approach is to fuse each driver independently. This allows you to apply the most appropriate protection for the type of driver being used. In general, low-frequency drivers (woofers) are the most susceptible to thermal damage and high-frequency drivers (tweeters) are usually damaged by large transient voltages. This means that your loudspeakers will tend to have better protection when the woofers are protected by slow-blow fuses and high-frequency drivers are protected by high-speed instrument fuses.

## 3.4 AC Mains Power Requirements

All *Micro-Tech* amplifiers are shipped with an appropriate line cord and plug. The standard cord and plug for each model are listed by country (or region) in Figure 3.16. When possible, use a power receptacle on a dedicated circuit, and always make sure it will provide the right voltage with sufficient current. We do not recommend operating your amplifier with voltages greater than 10% above or below the unit's rated voltage. For example, an amplifier rated for 120 VAC operaton should not exceed 132 VAC. See Section 7 for power requirements under a variety of conditions.

| Country or Region | Micro-Tech 600 | | Micro-Tech 1200 | | Micro-Tech 2400 | |
|---|---|---|---|---|---|---|
| | Cord | Plug | Cord | Plug | Cord | Plug |
| Australia, New Zealand | 1.5 mm² | AS 3112 10 A | 1.5 mm² | AS 3112 10 A | 1.5 mm² | AS 3112 15 A |
| Argentina, Austria, China, Denmark, Finland, France, Germany, Greece, Holland, Indonesia, Italy, Korea, Malaysia, Portugal, Spain, Sweden, Switzerland, Turkey | 1.5 mm² | CEE 7/7 | 1.5 mm² | CEE 7/7 | 1.5 mm² | CEE 7/7 |
| Brazil, Guam, Hong Kong, Jamaica, Japan, Peru, Phillipines, Singapore, Tahiti, Taiwan, Thailand, Venezuela | 14/3 SJT | NEMA 5-15P | 14/3 SJT | NEMA 5-15P | 12/3 SO | NEMA 5-15P |
| Central America, North America | 14/3 SJT | NEMA 5-15P | 14/3 SJT | NEMA 5-15P | 12/3 SO | NEMA 5-20P |
| India, South Africa | 1.5 mm² | BS 546 | 1.5 mm² | BS 546 | 1.5 mm² | BS 546 |
| Ireland, Norway, United Kingdom, United Arab Emirates | 1.5 mm² | BS 1363 | 1.5 mm² | BS 1363 | 1.5 mm² | BS 1363 |

*Fig. 3.16 AC Mains Cords and Plugs*

All specifications in this manual were measured using 120 VAC, 60 Hz power mains unless otherwise noted. Specifications are derived using a mains voltage that is accurate to within 0.5% with THD less than 1.0% under all testing conditions. Performance variations can occur at other AC mains voltages and line frequencies. In addition, line regulation problems will directly affect the output power available from the amplifier.

# 4 Operation

## 4.1 Precautions

Although your amplifier is protected from internal and external faults, you should still take the following precautions for optimum perfromance and safety:

1. Improper wiring for the Stereo, Bridge-Mono and Parallel-Mono modes can result in serious operating difficulties (see Section 3.3).

2. **WARNING: Do not change the position of the stereo/mono switch unless the amplifier is first turned off.**

3. **CAUTION: In Parallel-Mono mode, a jumper is used between the red (+) channel 1 and 2 red output binding posts. Remove this jumper for Bridge-Mono and Stereo modes, or high distortion and excessive heating will occur.** Also, check the stereo/mono switch for proper setting.

4. **Turn off the amplifier and unplug it from the AC mains** before removing the back panel cover plate or before removing and cleaning the dust filter.

5. Use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own!

6. Do not short the ground lead of an output cable to the input signal ground. This will form a ground loop and may cause oscillations.

7. Operate the amplifier from AC mains of not more than 10% above or below the selected line voltage and only at the specified line frequency.

8. **Never connect the output to a power supply output, battery or power main.** Such connections may result in electrical shock.

9. Tampering with the circuitry by unqualified personnel or making unauthorized circuit changes may be hazardous and invalidates all agency listings.

*Remember: Crown is not liable for damage that results from overdriving other system components.*

## 4.2 Indicators

The amber **enable indicator** is provided to show that the amplifier has been turned on (or enabled), and its low-voltage power supply and forced-air cooling system are working. It does not indicate the status of the high-voltage power supplies. For example, the enable indicator will remain lit during unusual conditions that would cause the amplifier's protection systems to temporarily remove power from a high-voltage power supply (see Section 4.3).

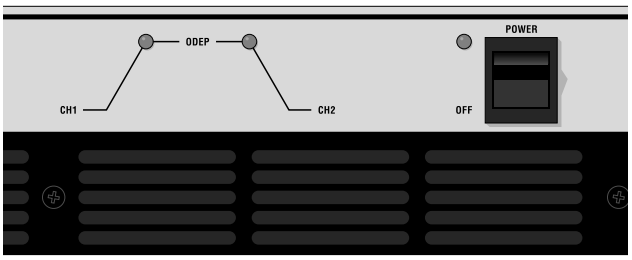



*Fig. 4.1 Indicators*

The amber ***ODEP* indicators** confirm the normal operation of Crown's patented Output Device Emulation Protection circuitry. Each channel has an amber front panel indicator that shows thermal-dynamic energy reserve. Normally, each ODEP indicator is lit to show available reserve energy. The indicator will dim proportionally as the energy reserve for its channel decreases. In the rare event that a channel has no reserve, its indicator will turn off and the ODEP circuitry will limit the channel's output drive (see Section 4.3.1.)

The *ODEP* indicators also turn off if the amplifier loses AC power, the power switch is turned off, or the low-voltage power supply fuse blows. The *ODEP* indicator for the affected channel will turn off if a high-voltage power supply fuse or breaker blows, or if the channel activates transformer thermal protection. Conditions that activate "drive protection" do not affect the *ODEP* indicators (see Section 4.3.3).

## 4.3 Protection Systems

*Micro-Tech* amplifiers have extensive protection systems including *ODEP*, ultrasonic/RF protection, drive protection, and power supply fuses or breakers.

### 4.3.1 *ODEP*

Crown invented *ODEP* to solve two long-standing problems in amplifier design: to prevent amplifier shutdown during demanding operation, and to increase the efficiency of the output circuitry.

To do this, Crown established a rigorous program to measure the *safe operating area* (SOA) of each output transistor before installing it in an amplifier. Next, Crown designed intelligent circuitry to simulate the instantaneous operating conditions of those output transistors. Its name describes what it does: Output Device Emulation Protection or *ODEP*. In addition to simulating output transistor operating conditions, it compares their operation to their known SOA. If *ODEP* sees that more power will be asked of the output devices than they are capable

of delivering under the present conditions, *ODEP* immediately limits the drive level until it falls within the SOA. Limiting is proportional and kept to an absolute minimum—only what is required to prevent output transistor damage. Under normal conditions, no limiting is required and *ODEP* is transparent to the audio signal.

This level of protection enables Crown to increase output efficiency to never-before-achieved levels while greatly increasing reliability. As described in the previous section, the on-board intelligence is monitored by the front panel *ODEP* indicators that show whether the amplifier is functioning correctly or if *ODEP* is limiting the drive level.

With *ODEP* you get maximum power with maximum protection so the show goes on.

#### 4.3.2 Ultrasonic and Radio Frequency Protection

*Micro-Tech* amplifiers have a controlled slew rate. This means that their design limits the frequencies they can reproduce. At the same time, the amplifier's controlled slew rate has no effect on its audio performance because limiting occurs well above 20 kHz. This approach protects the amplifier from radio frequencies, and also protects some sensitive loads (like tweeters). In the real world, an amplifier's slew rate only needs to be large enough to deliver the maximum voltage at the highest required frequency—higher slew rates actually allow the reproduction of undesirable frequencies.

#### 4.3.3 Drive Protection

The drive protection system temporarily removes drive from the output stages to protect the amplifier and its connected loads. Drive protection can be activated in two situations. First, if dangerous subsonic frequencies or direct current (DC) is detected in the amplifier's output, the unit will activate its DC/low-frequency protection circuitry which puts the affected channel in drive protection mode. This protects the loads and prevents oscillation. The amplifier resumes normal operation when it no longer detects dangerous output. Although it is extremely unlikely that you will ever activate the amplifier's DC/low-frequency protection system, improper source materials like subsonic square waves or a severely clipped signal can activate this system.

The amplifier's fault protection system puts the affected channel into drive protection mode in rare situations where heavy common-mode current is detected in its output. The amplifier should never output heavy common-mode current unless its circuitry is damaged. Activating drive protection helps prevent further damage.

#### 4.3.4 Transformer Thermal Protection

All *Micro-Tech* amplifiers have transformer thermal protection. The amplifier's transformer thermal protection circuitry is activated in very unusual circumstances where the unit's transformer temperature rises to unsafe levels. Under these abnormal conditions, the amplifier will remove power from the affected channel's high-voltage power supply which puts the channel in drive protection mode. The amplifier channel will return to normal operation after its transformer cools to a safe temperature.

It is extremely unlikely that you will ever see a *Micro-Tech* amplifier activate transformer thermal protection as long as it is operated within rated conditions (see Section 6, *Specifications*). One reason is that *ODEP* keeps the amplifier working under very severe conditions. Even so, higher than rated output levels, excessively low-impedance loads and unreasonably high input signals can generate more heat in the transformer than in the output devices. These conditions can overheat a transformer and activate its protection system.

*Micro-Tech* amplifiers are designed to keep working under conditions where other amplifiers would fail. But even when a *Micro-Tech's* limits are exceeded, it will still protect itself—and your investment—from damage.

#### 4.3.5 Fuses and Circuit Breakers

120 VAC, 60 Hz models and all *Micro-Tech 2400s* have an internal fuse that protects the low-voltage power supply and cooling fan. The high-voltage power supplies for the *Micro-Tech 600* and *1200* are protected by internal fuses, while the power supplies for the *Micro-Tech 2400* high-voltage supplies are protected by circuit breakers. With rated loads and output levels, the fuses (or circuit breakers) should only shut down the amplifier in the rare instance of a catastrophic failure. *ODEP* protection keeps the amplifier operational under most other severe conditions. The fuses (or circuit breakers) can also shut down the amplifier in cases where extremely low-impedance loads and high output levels result in current draw that exceeds their rating. Again, this should only be possible when operating *outside rated conditions* like when the amplifier is used to drive a 1 ohm load in Stereo mode, or when an input signal is clipped severely.

*Micro-Tech* amplifiers do not blow their fuses or trip their breakers unless something is wrong. In the rare event that an internal fuse blows, please refer the unit to a qualified technician. If a breaker in a *Micro-Tech 2400* trips, try to identify and correct the problem before resetting the breakers. If the problem persists, refer the unit to a qualified technician.

## 4.4 Controls

The **power switch** is located on the front panel so you can easily turn the amplifier on or off. If you ever need to make any wiring or installation changes, don't forget to disconnect the power cord. Please follow these steps when first turning on your amplifier:

1. Turn down the level of your audio source. For example, set your mixer's volume to "∞" (off).
2. Turn down the amplifier's level controls located on the back panel.
3. Turn on the power switch. The enable indicator beside the switch should glow.
4. After the turn-on delay, turn up the level of your audio source to the maximum desired level.
5. Turn up the level controls on the back panel of the amplifier until the maximum desired loudness or power level is achieved.
6. Turn down the level of your audio source to its normal range.

You can adjust each channel's output using the back panel **level controls**. These controls are located on the back panel to help prevent unwanted tampering.

A three-position **input sensitivity switch** is located inside the amplifier's back panel cover plate. The switch is set at the factory to a sensitivity of 0.775 volts for standard 1 kHz power into 8 ohms.* If desired, the sensitivity can be switched to 1.4 volts for standard 1 kHz power into 8 ohms, or a voltage gain of 26 dB. The 26 dB gain setting is equivalent to a sensitivity of 2.1 volts for the *Micro-Tech 600*, 2.5 volts for the *Micro-Tech 1200* and 3.2 volts for the *Micro-Tech 2400*.

*Factory setting for International versions is 1.4 V.

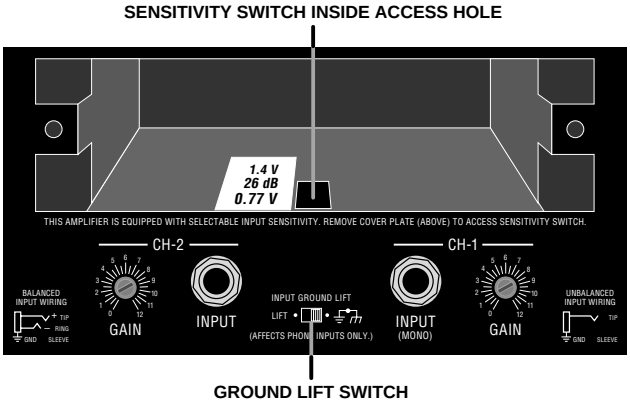



*Fig. 4.2 Input Sensitivity and Ground Lift Switches*

To change the input sensitivity:

1. Turn off the amplifier and disconnect its power cord from the AC power source.
2. Remove the back panel cover plate (or input connector accessory).
3. Locate the access hole for the sensitivity switch inside the chassis opening (Figure 4.2). The sensitivity switch will not be visible because it is mounted below the hole. Use your little finger to reach it.
4. Set the switch to the desired position noted on the label beside the access hole.
5. Replace the back panel cover plate (or input connector accessory) and restore power.

The back panel **stereo/mono switch** is used to select Stereo, Bridge-Mono or Parallel-Mono operating mode. Power must be removed from the amplifier before selecting a different operating mode. There are also important wiring differences among the different modes, so be sure to read Section 3.3 before changing the position of the stereo/mono switch.

The **ground lift switch** is located on the back panel and can isolate the input signal grounds from the AC (chassis) ground. It affects only the phone jack inputs and has no affect on accessory input connectors. Sliding the switch to the left isolates or "lifts" the grounds by placing an impedance between the sleeve of each phone jack and the AC ground.

The *Micro-Tech 2400* has two **reset switches** for its high-voltage power supplies. Refer to Section 4.3.5 in the unusual event of a tripped breaker.

## 4.5 Filter Cleaning

A dust filter is provided on the air intake to the cooling system (Figure 2.1). If this filter becomes clogged, the unit will not cool as efficiently as it should and may produce lower-than-normal output levels due to high heat sink temperature.

To remove the filter, use a phillips screwdriver to remove the three screws that hold the front grille in place. Wash the filter with mild dishwashing detergent and warm water. Be sure to dry the filter before reinstalling it. Replacement filters may be ordered from the factory.

Dust filters are not 100% efficient—depending on the local environment, the internal heat sinks of the amplifier will benefit from periodic cleaning by a qualified technician. Internal cleaning information is available from our Technical Support Group.

# 5 Technical Information

## 5.1 Overview

*Micro-Tech* amplifiers incorporate several technological advancements including real-time computer simulation of output transistor stress, low-stress output stages and an advanced heat sink embodiment.

Custom circuitry is incorporated to limit temperature and current to safe levels making it highly reliable and tolerant of faults. Unlike many lesser amplifiers, it can operate at its voltage and current limits without self-destructing.

*Micro-Tech* amplifiers are protected from all common hazards that plague high-power amplifiers including shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain-destruction phenomenon, input overload and high-frequency blowups. The unit protects loudspeakers from input and output DC, as well as turn-on and turn-off transients.

Real-time computer simulation is used to create an analogue of the junction temperature of the output transistors (hereafter referred to as the output devices). Current is limited only when the device temperature becomes excessive—and only by the minimum amount required). This patented approach called Output Device Emulation Protection (or *ODEP*) maximizes the available output power and protects against overheating—the major cause of device failure.

Crown also invented the four-quadrant topology used in the output stages of each *Micro-Tech* amplifier (see Figure 5.1). This special circuitry is called the *Grounded Bridge*. It makes full use of the power supply by delivering peak-to-peak voltages to the load that are twice the voltage seen by the output devices.

As its name suggests, the *Grounded Bridge* topology is referenced to ground. Composite devices are constructed as gigantic NPN and PNP devices to handle currents which exceed the limits of available devices. Each output stage has two composite NPN devices and two composite PNP devices.

The devices connected to the load are referred to as “high-side NPN and PNP” and the devices connected to ground are referred to as “low-side NPN and PNP.” Positive current is delivered to the load by increasing conductance simultaneously in the high-side NPN and low-side PNP stage, while decreasing conductance of the high-side PNP and low-side NPN.

The two channels may be used together to double the voltage (Bridge-Mono) or current (Parallel-Mono) presented to the load. This feature gives you flexibility to maximize power available to the load.

A wide bandwidth, multiloop design is used for state-of-the-art compensation. This produces ideal behavior and results in ultra-low distortion values.

Aluminum extrusions have been widely used for heat sinks in power amplifiers due to their low cost and reasonable performance. But measured on a watts per pound or watts per volume basis, the extrusion technology doesn’t perform nearly as well as the heat sink technology developed for *Micro-Tech* amplifiers.

The heat sinks in a *Micro-Tech* amplifier are fabricated from custom convoluted fin stock that provides an extremely high ratio of area to volume, or area to weight. All power devices are mounted directly to massive heat spreaders that are electrically at the Vcc potential. Making the heat spreaders electrically alive improves thermal performance by eliminating the insulating interface underneath each power device. The chassis itself is also used as part of the thermal circuit to maximize utilization of the available resources.

## 5.2 Circuit Theory

Each channel is powered by its own power transformer T100 or T200. Both channels share a common low-voltage supply. The secondary output of T100 is full-wave rectified by D109 and is filtered by a large computer grade capacitor. A thermal switch embedded in the transformer protects it from overheating.

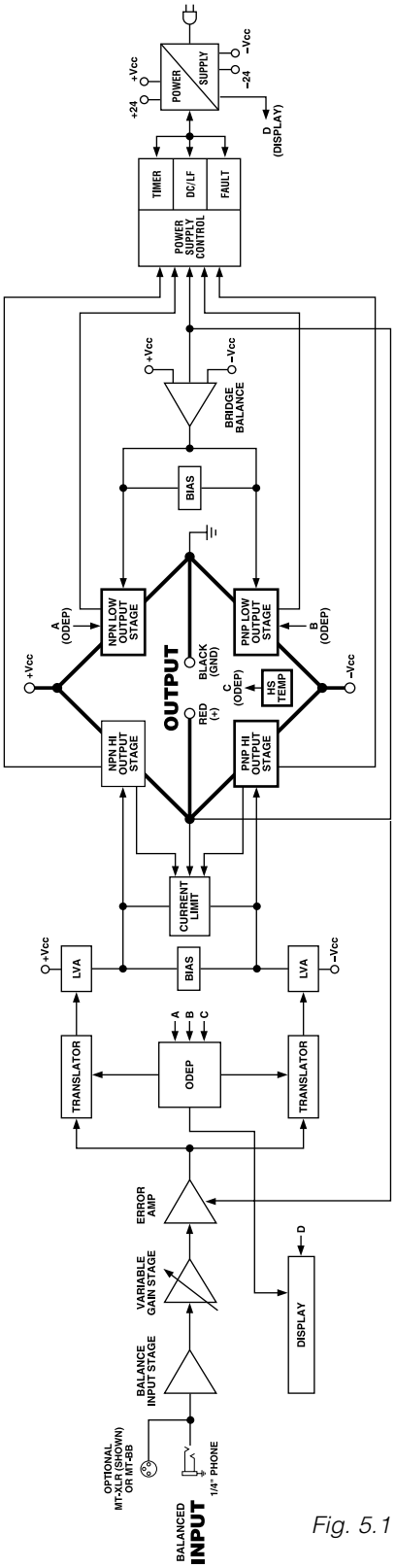
The low-voltage fanformer is rectified by diodes D1, D2, D3 and D4 to generate an unregulated 24 volts. Monolithic regulators U1 and U2 provide a regulated ±15 volts.

### 5.2.1 Stereo Operation

For simplicity, the discussion of Stereo operation will refer to one channel only. Mono operation will be discussed later. For specific circuit references, see the block diagram in Figure 5.1.

The signal at the ¼-inch phone jack input passes directly to the balanced gain stage (U104-A and U104-B). The balanced gain stage causes balanced to single-ended conversion using a difference amplifier. From there, gain can be controlled with a potentiometer. The error amp (U104-C) amplifies the difference between the output signal and the input signal from the gain pot, and drives the voltage translator stage.

From the error amp, the voltage translator stage routes the signal to the Last Voltage Amplifiers (LVAs) based on signal polarity. The +LVA (Q105) and the –LVA (Q110),




ONLY ONE CHANNEL SHOWN

*Fig. 5.1 Circuit Block Diagram*

with their push-pull effect through the bias servo Q318, drive the fully complementary output stage.

The bias servo Q318 is thermally coupled to the heat sink and sets the quiescent bias current in the output stage to lower the distortion in the crossover region of the output signal. D301, D302, D303, and D304 remove the charge on the unused portion of the output stage based on the polarity of the output signal.

With the voltage swing provided by the LVAs, the signal then gains current amplification through the Darlington emitter-follower output stage.

The bridge-balanced circuit (U104-D) receives a signal from the output of the amplifier and compares it to the signal at the Vcc supply. The bridge-balanced circuit then develops a voltage to drive the bridge-balanced output stage. This results in the Vcc supply having exactly one half of the output voltage added to their quiescent voltage. D309, D310, D311 and a trimmer resistor set the quiescent current point for the bridge-balanced output stage.

The protection mechanisms that affect the signal path are implemented to protect the amplifier under real-world conditions. These conditions are high instantaneous current, excessive temperature, and output device operation outside safe conditions.

Q107 and Q108 sense output current and act as a common current limiter. When instantaneous current exceeds the design criteria, the limiters remove the drive from the LVAs to limit output current to safe levels.

To further protect the output stages, the patented *ODEP* circuitry is used. It produces an analog output proportional to the always changing die temperature of the output transistor. This output controls the translator stage previously mentioned, removing any further drive that may exceed the *safe operating area* of the output stage.

Thermal sensors S100 and S200 give the *ODEP* circuits vital information on the operating temperature of the heat sink on which the output devices are mounted.

Should the amplifier fail in a way that would cause DC across the output lead, the DC protection circuit senses this on the negative feedback loop and shuts down the output stage drive until the DC is removed.

### 5.2.2 Bridge-Mono Operation

By setting the back panel stereo/mono switch to Bridge-Mono, you can convert a *Micro-Tech* amplifier for bridged-mono operation. With a signal applied to the channel 1 input and the load connected between the positive (+) output terminals, twice the voltage can be delivered to the load.

The channel 1 output feeds the channel 2 error amp U204-A. The signal feeding channel 2 is inverted so the channel 2 output will have the opposite polarity of channel 1. This makes it possible to deliver twice as much voltage to the load while the protection mechanisms for each channel continue to work independently.

### 5.2.3 Parallel-Mono Operation

With the stereo/mono switch set to Parallel-Mono, the output of channel 2 is paralleled with that of channel 1. A suitable jumper capable of handling high current must be connected across the positive (+) output terminals to gain the benefits of this operating mode.

The signal path for channel 1 is the same as previously discussed, except that channel 1 also drives the output stage of channel 2. The balanced input, error amp, translators, and LVAs of channel 2 are disconnected and no longer control the channel 2 output stage. The channel 2 output stage and protection mechanisms are also coupled through S1 and function as one.

In Parallel-Mono mode, the amplifier can deliver twice the current of a single channel. Because the channel 2 *ODEP* circuit is coupled through S1, the amplifier gains additional protection if a fault occurs in the channel 2 output stage. The channel 2 *ODEP* circuit will limit the output of both output stages by removing the drive from the channel 1 voltage translator.

# 6 Specifications

The following applies to units in Stereo mode with with both channels driven into 8 ohm loads and an input sensitivity of 26 dB unless otherwise specified.

**Standard 1 kHz Power:** refers to maximum average power in watts at 1 kHz with 0.1% THD.

**Full Bandwidth Power:** refers to maximum average power in watts from 20 Hz to 20 kHz with 0.1% THD.

**120 VAC, 60 Hz Units:** refers to amplifiers with dedicated transformers for 120 VAC, 60 Hz power mains.

**International Units:** refers to amplifiers with special multi-tap transformers that can be configured for several AC mains voltages (some may be labeled 601, 1201 or 2401).

## Performance

**Frequency Response:** ±0.1 dB from 20 Hz to 20 kHz at 1 watt (see Figure 6.7).

**Phase Response:** ±10 degrees from 10 Hz to 20 kHz at 1 watt (see Figure 6.10).

**Signal-to-Noise:** A-weighted, better than 105 dB below full bandwidth power. From 20 Hz to 20 kHz, better than 100 dB below full bandwidth power.

**Total Harmonic Distortion (THD):** Less than 0.05% at full bandwidth power from 20 Hz to 1 kHz increasing linearly to 0.1% at 20 kHz.

**Intermodulation Distortion (IMD):** (60 Hz and 7 kHz 4:1) Less than 0.05% from 163 milliwatts to full bandwidth power.

**Damping Factor:** Greater than 1,000 from 10 Hz to 400 Hz (see Figure 6.8).

**Crosstalk:** See Figures 6.11, 6.12 and 6.13.

**Controlled Slew Rate:** Greater than 13 volts/µs.

**Common Mode Rejection (CMR):** At rated full bandwidth power, better than 70 dB from 20 Hz to 1 kHz falling linearly to better than 50 dB at 20 kHz.

**Voltage Gain:** 20:1 ±6% or 26 dB ±0.5 dB at the maximum level setting (also see Section 4.4).

*Micro-Tech 600*: 55:1 ±+6% or 35 dB ±0.5 dB at 0.775-volt sensitivity; 31:1 ±6% or 30 dB ±0.5 dB at 1.4-volt sensitivity.

*Micro-Tech 1200*: 64:1 ±6% or 36 dB ±0.5 dB at 0.775-volt sensitivity; 34:1 ±6% or 31 dB ±0.5 dB at 1.4-volt sensitivity.

*Micro-Tech 2400*: 83:1 ±6% or 38 dB ±0.5 dB at 0.775-volt sensitivity; 46:1 ±6% or 33 dB ±0.5 dB at 1.4-volt sensitivity.

## Power

**Output Power:** *The following are guaranteed minimums for standard 1-kHz power from 120 VAC, 60 Hz North American units. For more information or specifications on international units, see the power matrices that follow.*

*Micro-Tech 600*

*Stereo mode (both channels driven):*

400 watts into 2 ohms.
325 watts into 4 ohms.
220 watts into 8 ohms.

*Bridge-Mono mode:*

750 watts into 4 ohms.
655 watts into 8 ohms.
450 watts into 16 ohms.

*Parallel-Mono mode:*

700 watts into 1 ohm.
665 watts into 2 ohms.
450 watts into 4 ohms.

*Micro-Tech 1200*

*Stereo mode (both channels driven):*

675 watts into 2 ohms.
480 watts into 4 ohms.
310 watts into 8 ohms.

*Bridge-Mono mode:*

1,300 watts into 4 ohms.
970 watts into 8 ohms.
620 watts into 16 ohms.

*Parallel-Mono mode:*

1,300 watts into 1 ohm.
965 watts into 2 ohms.
620 watts into 4 ohms.

*Micro-Tech 2400*

*Stereo mode (both channels driven):*

1,050 watts into 2 ohms.
800 watts into 4 ohms.
520 watts into 8 ohms.

*Bridge-Mono mode:*

2,070 watts into 4 ohms.
1,585 watts into 8 ohms.
1,035 watts into 16 ohms.

*Parallel-Mono mode:*

2,080 watts into 1 ohm.
1,605 watts into 2 ohms.
1,035 watts into 4 ohms.

**Load Impedance:** Safe with all types of loads. Rated for 2 to 16 ohms in Stereo, 4 to 16 ohms in Bridge-Mono and 1 to 4 ohms in Parallel-Mono mode.

**Required AC Mains:** 100, 120, 220 and 240 VAC (±10%), 50 and 60 Hz units are available. All units draw 90 watts or less when idle. AC mains current, frequency and voltage requirements are provided on the unit's back panel (also see Section 7).

*Important: Your amplifier must have sufficient AC power. Amplifiers cannot create energy—they require proper voltage and current to deliver the power you expect.*

## Controls

**Power:** A front panel rocker switch used to turn the amplifier on and off.

**Level:** A back panel rotary potentiometer for each channel used to control the output level.

**Stereo/Mono:** A three-position back panel switch used to select Stereo, Bridge-Mono or Parallel-Mono mode.

**Sensitivity:** A three-position switch inside the back cover plate used to select the input sensitivity for both channels: 0.775 volts or 1.4 volts for standard 1 kHz power into 8 ohms, or 26 dB gain (see Section 4.4).

**Ground Lift:** A two-position back panel switch used to isolate the phone jack input grounds from the AC ground.

**Reset (*Micro-Tech 2400* only):** A back panel push button for each channel used to reset the circuit breaker for each channel.

## Indicators

**Enable:** This amber indicator shows the on/off status of the low-voltage power supply and cooling fan.

***ODEP:*** Each channel has an amber front panel indicator that shows thermal-dynamic energy reserve. Normally, each ODEP indicator is lit to show available reserve energy. The indicator will dim proportionally as the energy reserve for its channel decreases. In the rare event that a channel has no reserve, its indicator will turn off and the ODEP circuitry will limit the channel's output drive. They remain off if the power is turned off, disconnected, or if the low-voltage power supply fuse blows. A channel's *ODEP* indicator will also remain off if its high-voltage supply fuse blows (or breaker opens) or if transformer thermal protection is activated.

## Input/Output

**Input Connector:** Two balanced ¼-inch phone jacks. See Section 8.2 for XLR and barrier block accessories.

**Input Impedance:** Nominally 20 K ohms, balanced. Nominally 10 K ohms, unbalanced.

**Input Sensitivity:** Settings include 0.775 volts and 1.4 volts for standard 1 kHz power, or 26 dB gain (see Section 4.4).

**Output Connectors:** Two sets of color-coded binding posts for banana plugs, spade lugs or bare wire (European models do not accept banana plugs).

**Output Impedance:** Less than 10 milliohms in series with less than 2 microhenries (see Figure 6.9).

**DC Output Offset:** (Shorted input) ±10 millivolts.

## Output Signal

**Stereo:** Unbalanced, two-channel.

**Bridge-Mono:** Balanced, single-channel. Channel 1 controls are active; channel 2 should be turned down.

**Parallel-Mono:** Unbalanced, single-channel. Channel 1 controls are active; channel 2 is bypassed.

## Protection

*Micro-Tech* amplifiers are protected against shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain destruction phenomena, input overload damage and high-frequency blowups. They also protect loudspeakers from input/output DC and turn-on/turn-off transients.

If unreasonable operating conditions occur, the patented *ODEP* circuitry will proportionally limit the drive level to protect the output stages, particularly in the case of elevated temperature. Transformer overheating will result in a temporary shutdown of the affected channel; when it has cooled to a safe temperature, the transformer will automatically reset itself. Controlled slew rate voltage amplifiers prevent RF burnouts, and input overload protection is provided by the input current limit. Refer to Section 4.3.

**Turn On:** The four-second turn-on delay prevents dangerous turn-on transients. Turn-on occurs at zero crossing of the AC waveform, so power sequencers are rarely needed with multiple units. *Note: To change the turn-on delay time, contact Crown's Technical Support Group.*

## Construction

Steel chassis with durable black finish, front panel Lexan overlay and specially designed "flow-through" ventilation from front to side panels.

**Cooling:** Internal heat sinks with forced-air cooling for rapid, uniform heat dissipation.

**Dimensions:** Standard 19-inch (48.3-cm) rack mount width (EIA RS-310-B), 3.5-inch (8.9-cm) height and 16-inch (40.6-cm) depth behind the mounting surface.

**Approximate Weight:** Center of gravity is 6 inches (15.2 cm) behind the front mounting surface.

**120 VAC, 60 Hz Units:**

*Micro-Tech 600*: 36 pounds, 4 ounces (16.5 kg) net; 41 pounds, 2 ounces (18.7 kg) shipping weight.

*Micro-Tech 1200*: 41 pounds, 1 ounce (18.6 kg) net; 45 pounds, 3 ounces (20.5 kg) shipping weight.

*Micro-Tech 2400*: 46 pounds, 14 ounces (21.3 kg) net; 55 pounds, 12 ounces (25.3 kg) shipping weight.

**International Units:**

*Micro-Tech 600*: 39 pounds, 7 ounces (17.9 kg) net; 44 pounds, 2 ounces (20.0 kg) shipping weight.

*Micro-Tech 1200*: 41 pounds, 0 ounces (18.6 kg) net; 45 pounds, 4 ounces (20.5 kg) shipping weight.

*Micro-Tech 2400*: 47 pounds, 9 ounces (21.6 kg) net; 56 pounds, 6 ounces (25.6 kg) shipping weight.

### *Crown specifications are guaranteed for three years.*

In an effort to provide you with as much information as possible about the high power-producing capabilities of your amplifier, we have created the following power matrices.

## Minimum Power Specifications

Crown's minimum power specifications represent the absolute smallest amount of output power you can expect from your amplifier when it is driven to full output under the given conditions. Some spaces in each matrix may be left blank because the same guarantee is not provided for those conditions—however, your amplifier will perform well under all conditions listed in each matrix.

When measuring power, 0.1% THD appears to be the industry standard for distortion. Two of the maximum average power specifications shown in each minimum power matrix are measured at 0.1% THD so you can easily compare Crown specifications to those of other manufacturers. But this high level of distortion actually allows for some clipping which is undesirable. Because of this, a maximum average power specification at 0.05% THD is included in each minimum power matrix which represents non-clipped conditions. Although most manufacturers do not give you power specifications at 0.05% THD, we encourage them to provide these specifications so you will have a more realistic representation of the way amplifiers should be used in the real world—without a clipped output signal.

Many manufacturers publish power specs with a tolerance of ±1 dB or worse. This means their amplifier can deviate more than 20% in output! A 100-watt amplifier would meet their specification if it only produced 79.4 watts. Other manufacturers qualify their specifications by saying they are "typical," "subject to manufacturing tolerances," "single channel driven" or that they are specified with "fuses bypassed." Each of these statements effectively removes any performance guarantee. In fact, some manufacturers use these tactics to generate large power numbers, and they don't even print a disclaimer. We take a different approach at Crown—our amplifiers are *guaranteed* to meet or exceed their specifications for three years. Further, because our published specs are set below our "in-house" measurements, you can expect *every* Crown amplifier to *exceed* its published minimum power specs. We believe you should get what you pay for.

**Micro-Tech 600 – Minimum Guaranteed Power (Watts)**

| AC Mains | Stereo/Mono Mode | Load (Ohms) | Maximum Average 0.1% THD (See note 1) | Maximum Average 0.1% THD (See note 2) | Maximum Average 0.05% THD (See note 3) | FTC Continuous Average 0.1% THD (See note 4) | |
|---|---|---|---|---|---|---|---|
| | | | 1 kHz | 20Hz-20kHz | 1 kHz | 1 kHz | 20Hz-20kHz |
| 120 VAC, 60 Hz Units | **Stereo** (both channels driven) | 2 | 400 | 335 | 395 | | |
| | | 4 | 325 | 300 | 325 | 320 | 285 |
| | | 8 | 225 | 210 | 220 | 220 | 210 |
| | **Bridge-Mono** (balanced output) | 4 | 750 | 650 | 745 | | |
| | | 8 | 655 | 605 | 650 | 645 | 570 |
| | | 16 | 450 | 425 | 445 | 450 | 420 |
| | **Parallel-Mono** | 1 | 700 | | 695 | | |
| | | 2 | 665 | | 660 | 635 | |
| | | 4 | 450 | | 450 | 450 | |
| International Units | **Stereo** (both channels driven) | 2 | 380 | | 375 | | |
| | | 4 | 335 | 305 | 330 | 320 | 285 |
| | | 8 | 230 | 220 | 230 | 230 | 215 |
| | **Bridge-Mono** (balanced output) | 4 | 730 | | 725 | | |
| | | 8 | 680 | 625 | 670 | 645 | 565 |
| | | 16 | 465 | 440 | 465 | 465 | 430 |
| | **Parallel-Mono** | 1 | 680 | | 675 | | |
| | | 2 | 665 | | 665 | 645 | |
| | | 4 | 460 | | 455 | 455 | |

*Fig. 6.1 Micro-Tech 600 Minimum Power Matrix*

**Minimum Power Notes:**

All minimum power specifications are based on 0.5% regulated AC mains with THD of less than 1.0% and an ambient room temperature of 70° F (21° C). International units with multi-tap transformers are specified for the worst-case transformer tap (normally 100 VAC, 50 Hz). The standard EIA power measurement (RS-490) is not identified here because it is identical to the FTC Continuous Average Power specification.

1. A 1 kHz sine wave is presented to the amplifier and the output monitored for nonlinear distortion. The level is increased until THD reaches 0.1%. At this level the average power per channel is reported.
2. A sine wave is presented to the amplifier over the range from 20 Hz to 20 kHz and the output monitored for nonlinear distortion. The level at each frequency is increased until THD reaches 0.1%. At this level the average power per channel is reported.
3. A 1 kHz sine wave is presented to the amplifier and the output monitored for nonlinear distortion. The level is increased until THD reaches 0.05%. At this level the average power per channel is reported.
4. Continuous power in the context of Federal Trade Commission testing is understood to be a minimum of five minutes of operation. Harmonic distortion is measured as the RMS sum total and given as a percentage of the fundamental output voltage. This applies for all wattages greater than 0.25 watts.

| Micro-Tech 1200 – Minimum Guaranteed Power (Watts) | | | | | | | |
|---|---|---|---|---|---|---|---|
| AC Mains | Stereo/Mono Mode | Load (Ohms) | Maximum Average 0.1% THD (See note 1) | Maximum Average 0.1% THD (See note 2) | Maximum Average 0.05% THD (See note 3) | FTC Continuous Average 0.1% THD (See note 4) | |
| | | | 1 kHz | 20Hz-20kHz | 1 kHz | 1 kHz | 20Hz-20kHz |
| 120 VAC, 60 Hz Units | **Stereo** (both channels driven) | 2 | 675 | 585 | 660 | | |
| | | 4 | 480 | 450 | 480 | 475 | 425 |
| | | 8 | 310 | 295 | 305 | 305 | 295 |
| | **Bridge-Mono** (balanced output) | 4 | 1,300 | 1,130 | 1,285 | | |
| | | 8 | 970 | 895 | 960 | 960 | 850 |
| | | 16 | 620 | 590 | 615 | 620 | 585 |
| | **Parallel-Mono** | 1 | 1,300 | | 1,290 | | |
| | | 2 | 965 | | 960 | 950 | |
| | | 4 | 620 | | 615 | 610 | |
| International Units | **Stereo** (both channels driven) | 2 | 520 | 455 | 515 | | |
| | | 4 | 420 | 385 | 415 | 410 | 365 |
| | | 8 | 285 | 275 | 285 | 280 | 265 |
| | **Bridge-Mono** (balanced output) | 4 | 1,045 | 920 | 1,030 | | |
| | | 8 | 845 | 780 | 840 | 830 | 730 |
| | | 16 | 570 | 540 | 565 | 570 | 535 |
| | **Parallel-Mono** | 1 | 1,040 | | 1,040 | | |
| | | 2 | 845 | | 845 | 820 | |
| | | 4 | 570 | | 570 | 565 | |

*Fig. 6.2 Micro-Tech 1200 Minimum Power Matrix*

| Micro-Tech 2400 – Minimum Guaranteed Power (Watts) | | | | | | | |
|---|---|---|---|---|---|---|---|
| AC Mains | Stereo/Mono Mode | Load (Ohms) | Maximum Average 0.1% THD (See note 1) | Maximum Average 0.1% THD (See note 2) | Maximum Average 0.05% THD (See note 3) | FTC Continuous Average 0.1% THD (See note 4) | |
| | | | 1 kHz | 20Hz-20kHz | 1 kHz | 1 kHz | 20Hz-20kHz |
| 120 VAC, 60 Hz Units | **Stereo** (both channels driven) | 2 | 1,050 | 850 | 1,025 | | |
| | | 4 | 800 | 750 | 785 | 770 | 685 |
| | | 8 | 520 | 505 | 510 | 505 | 495 |
| | **Bridge-Mono** (balanced output) | 4 | 2,070 | 1,670 | 2,030 | | |
| | | 8 | 1,585 | 1,485 | 1,565 | 1,530 | 1,355 |
| | | 16 | 1,035 | 1,000 | 1,020 | 1,005 | 955 |
| | **Parallel-Mono** | 1 | 2,080 | | 2,050 | | |
| | | 2 | 1,605 | | 1,590 | 1,470 | |
| | | 4 | 1,035 | | 1,025 | 1,005 | |
| International Units | **Stereo** (both channels driven) | 2 | 895 | | 875 | | |
| | | 4 | 745 | 715 | 735 | 690 | 660 |
| | | 8 | 510 | 500 | 510 | 505 | 500 |
| | **Bridge-Mono** (balanced output) | 4 | 1,775 | | 1,735 | | |
| | | 8 | 1,485 | 1,420 | 1,475 | 1,395 | 1,320 |
| | | 16 | 1,030 | 1,000 | 1,020 | 1,010 | 980 |
| | **Parallel-Mono** | 1 | 1,765 | | 1,750 | | |
| | | 2 | 1,470 | | 1,460 | 1,400 | |
| | | 4 | 1,020 | | 1,010 | 1,000 | |

*Fig. 6.3 Micro-Tech 2400 Minimum Power Matrix*

## Maximum Power Specifications

Crown's maximum power specifications represent the largest amount of output power you can expect from your amplifier when it is driven to full output under the given conditions. These specifications can be used to prevent loudspeaker and hearing damage.

The maximum power matrices include specifications for single cycle and 40 millisecond burst sine waves. Burst signals act like large transient peaks that are present in common source signals. Loudspeakers can respond to a single cycle burst, so the single cycle burst specifications should be used to help you protect your loudspeakers. In contrast, a 40 millisecond burst represents the typical response time of the human ear. Your ear will not respond to the entire dynamic change of a burst that lasts less than 40 milliseconds.

The burst power specifications are provided at 0.05% THD which is a practical low distortion condition. Operating the amplifier at levels higher than 0.05% THD can result in output power levels that are higher than those listed in the maximum power matrices.

**Maximum Power Notes:**

All maximum power specifications are based on 0.5% regulated AC mains with THD of less than 1.0% and an ambient room temperature of 70° F (21° C). International units with multi-tap transformers are specified for the best-case transformer tap (normally 240 VAC, 60 Hz). Although it is an unusual condition, your amplifier can function well with AC mains voltages up to 10% over the specified line voltage. With overvoltage conditions, your amplifier may be capable of delivering instantaneous power levels up to 20% greater than the specifications in the matrix.

1. A single cycle sine wave is presented to the amplifier and monitored for nonlinear distortion. The average power during the burst is reported. Loudspeakers must be able to withstand this level if they are to be safely used with this amplifier.
2. A 40 millisecond sine wave burst (10 percent duty cycle) is presented to the amplifier and monitored for nonlinear distortion. The average power during the burst is reported. This power level is a measurement of the amplifier's maximum transient power that can be perceived by the human ear.

| Micro-Tech 600 – Maximum Power (Watts) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AC Mains | Stereo/Mono Mode | Load (Ohms) | Single Cycle Tone Burst 0.05% Distortion (See note 1) | | | | 40 Millisecond Tone Burst 0.05% Distortion (See note 2) | | |
| | | | 20 Hz | 50 Hz | 1 kHz | 7 kHz | 50 Hz | 1 kHz | 7 kHz |
| 120 VAC, 60 Hz Units | **Stereo** (both channels driven) | 2 | 460 | 460 | 475 | 495 | 460 | 430 | 455 |
| | | 4 | 350 | 430 | 575 | 560 | 375 | 340 | 355 |
| | | 8 | 255 | 280 | 325 | 320 | 245 | 235 | 245 |
| | **Bridge-Mono** (balanced output) | 4 | 820 | 910 | 930 | 940 | 910 | 855 | 895 |
| | | 8 | 700 | 860 | 1,165 | 1,130 | 750 | 685 | 710 |
| | | 16 | 510 | 565 | 655 | 640 | 510 | 465 | 485 |
| | **Parallel-Mono** | 1 | 905 | 920 | 940 | 970 | 920 | 860 | 890 |
| | | 2 | 765 | 865 | 1,155 | 1,120 | 750 | 690 | 710 |
| | | 4 | 520 | 560 | 650 | 635 | 510 | 465 | 485 |
| International Units | **Stereo** (both channels driven) | 2 | 450 | 495 | 505 | 515 | 490 | 460 | 490 |
| | | 4 | 375 | 475 | 615 | 605 | 415 | 370 | 385 |
| | | 8 | 260 | 310 | 350 | 345 | 270 | 250 | 260 |
| | **Bridge-Mono** (balanced output) | 4 | 945 | 970 | 985 | 990 | 970 | 915 | 960 |
| | | 8 | 745 | 950 | 1,240 | 1,210 | 825 | 730 | 770 |
| | | 16 | 520 | 620 | 700 | 680 | 545 | 500 | 525 |
| | **Parallel-Mono** | 1 | 880 | 915 | 930 | 970 | 915 | 895 | 940 |
| | | 2 | 740 | 960 | 1,230 | 1,225 | 845 | 735 | 765 |
| | | 4 | 525 | 610 | 700 | 675 | 540 | 505 | 530 |

*Fig. 6.4 Micro-Tech 600 Maximum Power Matrix*

| Micro-Tech 1200 – Maximum Power (Watts) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AC Mains | Stereo/Mono Mode | Load (Ohms) | Single Cycle Tone Burst 0.05% Distortion (See note 1) | | | | 40 Millisecond Tone Burst 0.05% Distortion (See note 2) | | |
| | | | 20 Hz | 50 Hz | 1 kHz | 7 kHz | 50 Hz | 1 kHz | 7 kHz |
| 120 VAC, 60 Hz Units | Stereo (both channels driven) | 2 | 685 | 885 | 1,050 | 1,060 | 755 | 685 | 725 |
| | | 4 | 515 | 620 | 770 | 750 | 535 | 500 | 525 |
| | | 8 | 350 | 375 | 420 | 410 | 345 | 320 | 335 |
| | Bridge-Mono (balanced output) | 4 | 1,475 | 1,730 | 2,025 | 1,945 | 1,475 | 1,395 | 1,395 |
| | | 8 | 1,030 | 1,240 | 1,585 | 1,640 | 1,120 | 1,040 | 1,120 |
| | | 16 | 675 | 745 | 870 | 890 | 695 | 665 | 695 |
| | Parallel-Mono | 1 | 1,325 | 1,735 | 1,980 | 2,010 | 1,495 | 1,340 | 1,405 |
| | | 2 | 1,010 | 1,230 | 1,515 | 1,465 | 1,060 | 980 | 1,030 |
| | | 4 | 690 | 750 | 830 | 810 | 675 | 630 | 660 |
| International Units | Stereo (both channels driven) | 2 | 635 | 850 | 1,075 | 1,090 | 755 | 640 | 680 |
| | | 4 | 490 | 620 | 810 | 785 | 550 | 485 | 505 |
| | | 8 | 330 | 385 | 440 | 425 | 350 | 320 | 335 |
| | Bridge-Mono (balanced output) | 4 | 1,255 | 1,650 | 2,090 | 2,120 | 1,495 | 1,265 | 1,330 |
| | | 8 | 990 | 1,255 | 1,615 | 1,565 | 1,105 | 980 | 1,020 |
| | | 16 | 655 | 765 | 880 | 850 | 695 | 640 | 670 |
| | Parallel-Mono | 1 | 1,240 | 1,635 | 1,980 | 1,995 | 1,485 | 1,250 | 1,315 |
| | | 2 | 975 | 1,250 | 1,605 | 1,555 | 1,075 | 965 | 1,005 |
| | | 4 | 655 | 765 | 890 | 855 | 685 | 645 | 665 |

*Fig. 6.5 Micro-Tech 1200 Maximum Power Matrix*

| Micro-Tech 2400 – Maximum Power (Watts) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AC Mains | Stereo/Mono Mode | Load (Ohms) | Single Cycle Tone Burst 0.05% Distortion (See note 1) | | | | 40 Millisecond Tone Burst 0.05% Distortion (See note 2) | | |
| | | | 20 Hz | 50 Hz | 1 kHz | 7 kHz | 50 Hz | 1 kHz | 7 kHz |
| 120 VAC, 60 Hz Units | Stereo (both channels driven) | 2 | 1,015 | 1,405 | 1,715 | 1,675 | 1,250 | 1,090 | 1,145 |
| | | 4 | 780 | 965 | 1,310 | 1,270 | 860 | 795 | 830 |
| | | 8 | 565 | 600 | 710 | 690 | 545 | 510 | 535 |
| | Bridge-Mono (balanced output) | 4 | 2,010 | 2,745 | 3,380 | 3,380 | 2,465 | 2,175 | 2,265 |
| | | 8 | 1,590 | 1,915 | 2,610 | 2,550 | 1,775 | 1,590 | 1,660 |
| | | 16 | 1,120 | 1,185 | 1,420 | 1,375 | 1,085 | 1,025 | 1,065 |
| | Parallel-Mono | 1 | 1,960 | 2,780 | 3,145 | 3,045 | 2,510 | 2,145 | 2,225 |
| | | 2 | 1,565 | 1,955 | 2,605 | 2,505 | 1,695 | 1,580 | 1,630 |
| | | 4 | 1,125 | 1,185 | 1,410 | 1,365 | 1,125 | 1,020 | 1,060 |
| International Units | Stereo (both channels driven) | 2 | 1,025 | 1,485 | 1,655 | 1,680 | 1,340 | 1,080 | 1,135 |
| | | 4 | 835 | 1,085 | 1,515 | 1,480 | 975 | 835 | 875 |
| | | 8 | 570 | 690 | 825 | 800 | 625 | 565 | 585 |
| | Bridge-Mono (balanced output) | 4 | 2,055 | 3,000 | 3,390 | 3,335 | 2,660 | 2,140 | 2,250 |
| | | 8 | 1,670 | 2,165 | 3,055 | 2,935 | 1,950 | 1,670 | 1,740 |
| | | 16 | 1,165 | 1,395 | 1,675 | 1,610 | 1,245 | 1,145 | 1,190 |
| | Parallel-Mono | 1 | 2,035 | 2,965 | 3,065 | 3,085 | 2,645 | 2,155 | 2,235 |
| | | 2 | 1,665 | 2,160 | 3,040 | 2,945 | 1,940 | 1,685 | 1,735 |
| | | 4 | 1,135 | 1,375 | 1,655 | 1,600 | 1,235 | 1,125 | 1,170 |

*Fig. 6.6 Micro-Tech 2400 Maximum Power Matrix*

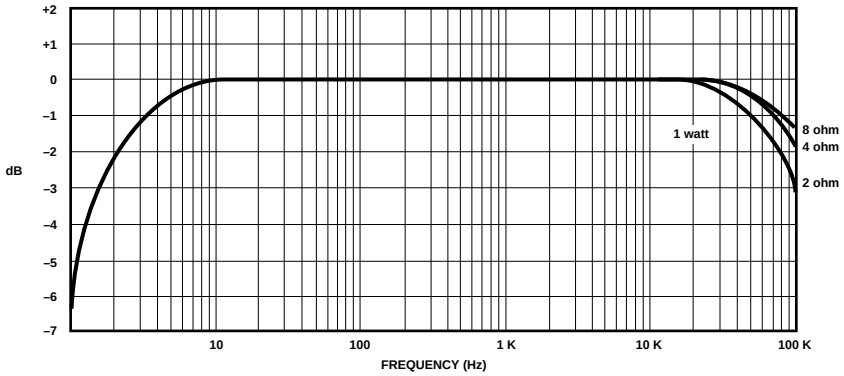



*Fig. 6.7 Typical Frequency Response*

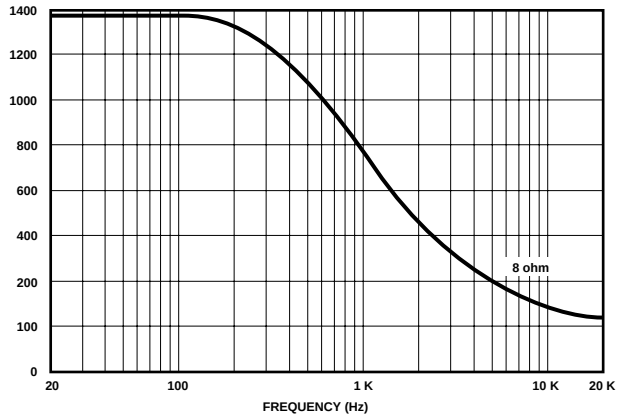



*Fig. 6.8 Typical Damping Factor*

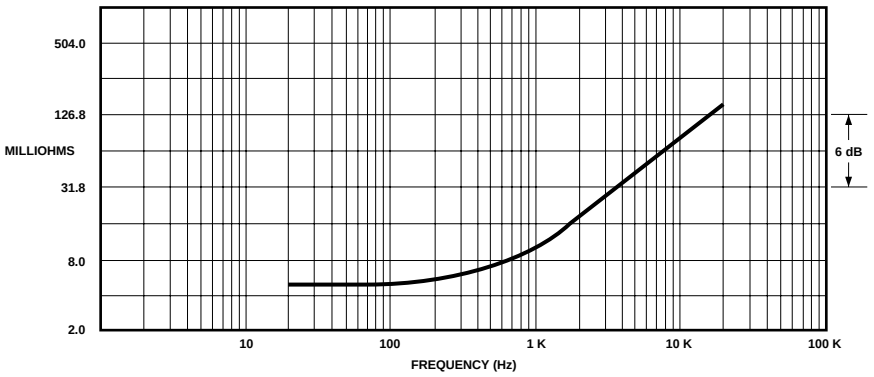



*Fig. 6.9 Typical Output Impedance*

TEF ®
Measurement

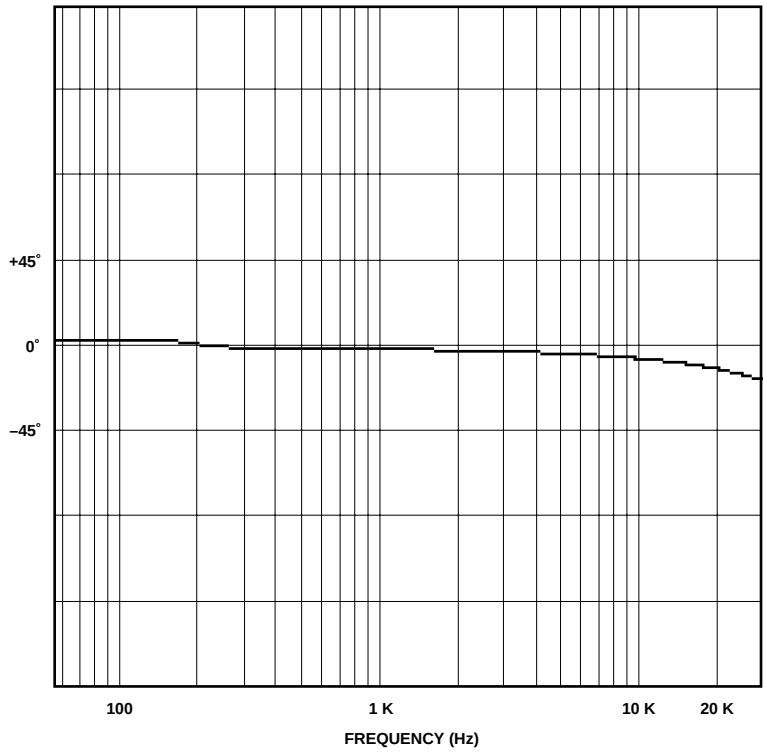



*Fig. 6.10 Typical Phase Response*

TEF ®
Measurement

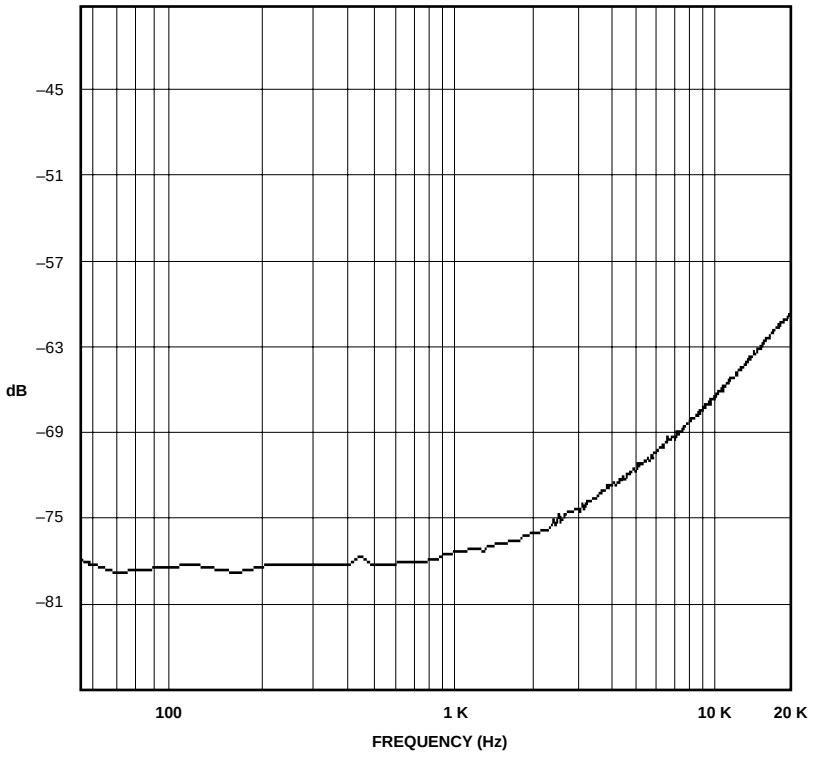



*Fig. 6.11 Typical Crosstalk for the Micro-Tech 600*

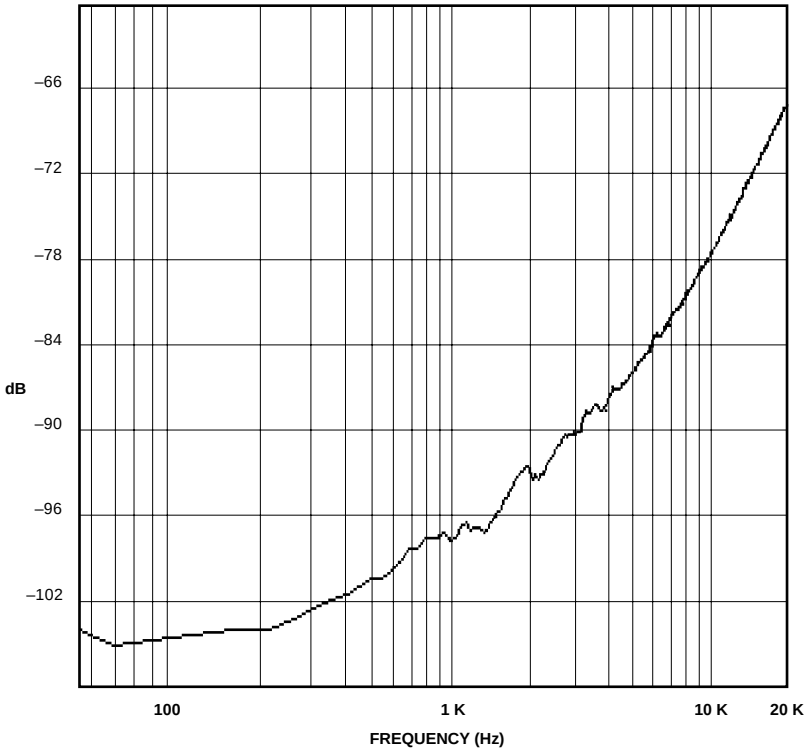



*Fig. 6.12 Typical Crosstalk for the Micro-Tech 1200*

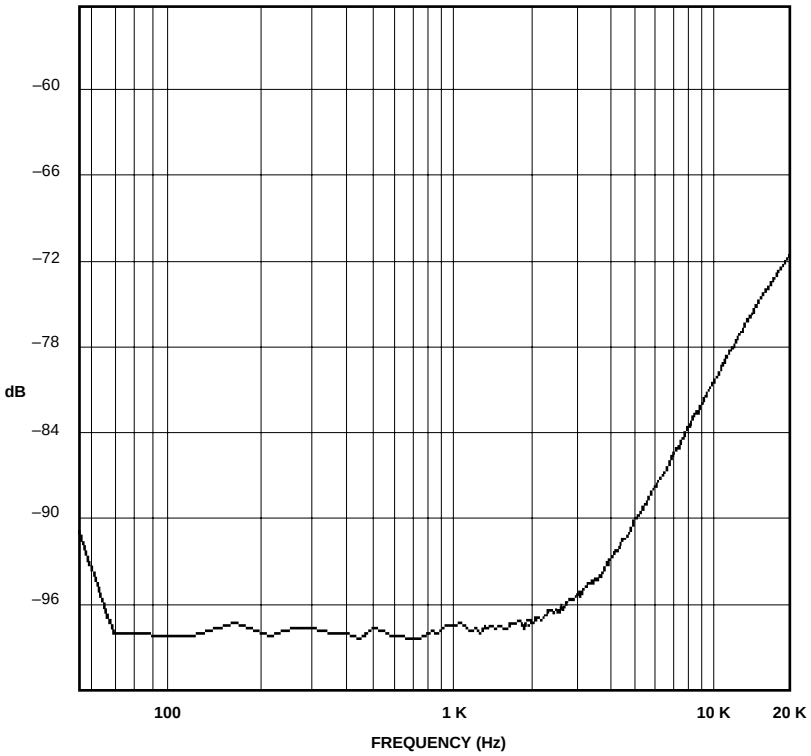



*Fig. 6.13 Typical Crosstalk for Micro-Tech 2400*

# 7 AC Power Draw and Thermal Dissipation

This section provides detailed information about the amount of power and current drawn from the AC mains by *Micro-Tech* amplifiers and the amount of heat produced under various conditions. The calculations presented here are intended to provide a realistic and reliable depiction of the amplifiers. The following assumptions or approximations were made:

- The amplifier's available channels are loaded, and full power is being delivered.
- Amplifier efficiency at standard 1 kHz power is estimated to be 65%.
- Typical quiescent power draw for the *Micro-Tech 600* is 65 watts; typical quiescent power draw for the *Micro-Tech 1200* and *2400* is 80 watts.
- Quiescent thermal dissipation equals 222 btu/hr at 65 watts and 273 btu/hr at 80 watts.
- The estimated duty cycles take into account the typical crest factor for each type of source material.
- Duty cycle of pink noise is 50%.
- Duty cycle of highly compressed rock 'n' roll midrange is 40%.
- Duty cycle of rock 'n' roll is 30%.
- Duty cycle of background music is 20%.
- Duty cycle of continuous speech is 10%.
- Duty cycle of infrequent paging is 1%.

Here are the equations used to calculate the data presented in Figures 7.1, 7.2 and 7.3:

$$\text{AC Mains Power Draw (watts)} = \frac{\text{Total output power with all channels driven (watts)} \times \text{Duty Cycle}}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)}$$

The quiescent power draw figures provided in the opposite column are typical and include power drawn by the fan. The following equation converts power draw in watts to current draw in amperes:

$$\text{Current Draw (amperes)} = \frac{\text{AC Mains Power Draw (watts)}}{\text{AC Mains Voltage} \times \text{Power Factor (.83)}}$$

The power factor of 0.83 is needed to compensate for the difference in phase between the AC mains voltage and current. The following equation is used to calculate thermal dissipation:

$$\text{Thermal Dissipation (btu/hr)} = \left( \frac{\text{Total output power with all channels driven (watts)} \times \text{Duty Cycle} \times .35}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)} \right) \times 3.415$$

The constant 0.35 is inefficiency (1.00–0.65) and the factor 3.415 converts watts to btu/hr. Thermal dissipation in btu is divided by the constant 3.968 to get kcal. If you plan to measure output power under real-world conditions, the following equation may also be helpful:

$$\text{Thermal Dissipation (btu/hr)} = \left( \frac{\text{Total measured output power from all channels (watts)} \times .35}{\text{Amplifier Efficiency (.65)}} + \text{Quiescent Power Draw (watts)} \right) \times 3.415$$

**Micro-Tech 600**

| | LOAD | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 Ohm Stereo / 16 Ohm Bridge-Mono / 4 Ohm Parallel-Mono | | | | | 4 Ohm Stereo / 8 Ohm Bridge-Mono / 2 Ohm Parallel-Mono | | | | | 2 Ohm Stereo / 4 Ohm Bridge-Mono / 1 Ohm Parallel-Mono | | | | |
| Duty Cycle | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | |
| | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr |
| 50% | 415 | 5.0 | 2.3 | 640 | 160 | 580 | 6.9 | 3.2 | 835 | 210 | 680 | 8.2 | 3.7 | 960 | 245 |
| 40% | 345 | 4.1 | 1.9 | 555 | 140 | 475 | 5.7 | 2.6 | 715 | 180 | 560 | 6.7 | 3.1 | 810 | 205 |
| 30% | 275 | 3.3 | 1.5 | 470 | 120 | 375 | 4.5 | 2.0 | 590 | 150 | 435 | 5.2 | 2.4 | 665 | 170 |
| 20% | 205 | 2.5 | 1.1 | 390 | 100 | 270 | 3.2 | 1.5 | 470 | 120 | 315 | 3.7 | 1.7 | 520 | 130 |
| 10% | 135 | 1.6 | 0.7 | 305 | 80 | 170 | 2.0 | 0.9 | 345 | 90 | 190 | 2.3 | 1.0 | 370 | 95 |

*Fig. 7.1 Micro-Tech 600 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles*

**Micro-Tech 1200**

| | LOAD | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 Ohm Stereo / 16 Ohm Bridge-Mono / 4 Ohm Parallel-Mono | | | | | 4 Ohm Stereo / 8 Ohm Bridge-Mono / 2 Ohm Parallel-Mono | | | | | 2 Ohm Stereo / 4 Ohm Bridge-Mono / 1 Ohm Parallel-Mono | | | | |
| Duty Cycle | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | |
| | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr |
| 50% | 560 | 6.7 | 3.0 | 845 | 215 | 830 | 10.0 | 4.5 | 1165 | 295 | 1120 | 13.5 | 6.1 | 1515 | 385 |
| 40% | 465 | 5.6 | 2.5 | 730 | 185 | 680 | 8.2 | 3.7 | 990 | 250 | 915 | 11.0 | 5.0 | 1270 | 320 |
| 30% | 370 | 4.4 | 2.0 | 615 | 155 | 530 | 6.4 | 2.9 | 810 | 205 | 705 | 8.5 | 3.9 | 1020 | 260 |
| 20% | 275 | 3.3 | 1.5 | 505 | 130 | 380 | 4.6 | 2.1 | 630 | 160 | 495 | 6.0 | 2.7 | 770 | 195 |
| 10% | 175 | 2.1 | 1.0 | 390 | 100 | 230 | 2.8 | 1.3 | 455 | 115 | 290 | 3.5 | 1.6 | 525 | 135 |

*Fig. 7.2 Micro-Tech 1200 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles*

**Micro-Tech 2400**

| | LOAD | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 Ohm Stereo / 16 Ohm Bridge-Mono / 4 Ohm Parallel-Mono | | | | | 4 Ohm Stereo / 8 Ohm Bridge-Mono / 2 Ohm Parallel-Mono | | | | | 2 Ohm Stereo / 4 Ohm Bridge-Mono / 1 Ohm Parallel-Mono | | | | |
| Duty Cycle | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | | AC Mains Power Draw (Watts) | Current Draw (Amps) | | Thermal Dissipation | |
| | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr | | 100-120 V | 220-240 V | btu/hr | kcal/hr |
| 50% | 880 | 10.6 | 4.8 | 1230 | 310 | 1315 | 15.8 | 7.2 | 1750 | 445 | 1695 | 20.4 | 9.3 | 2205 | 555 |
| 40% | 720 | 8.7 | 3.9 | 1040 | 265 | 1070 | 12.9 | 5.8 | 1455 | 370 | 1375 | 16.5 | 7.5 | 1820 | 460 |
| 30% | 560 | 6.7 | 3.1 | 850 | 215 | 825 | 9.9 | 4.5 | 1160 | 295 | 1050 | 12.6 | 5.7 | 1435 | 365 |
| 20% | 400 | 4.8 | 2.2 | 660 | 165 | 575 | 6.9 | 3.1 | 865 | 220 | 730 | 8.7 | 4.0 | 1050 | 265 |
| 10% | 240 | 2.9 | 1.3 | 465 | 120 | 330 | 3.9 | 1.8 | 570 | 145 | 405 | 4.9 | 2.2 | 660 | 170 |

*Fig. 7.3 Micro-Tech 2400 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles*

# 8 Accessories

## 8.1 Cooling Fan Options

Every *Micro-Tech* amplifier has a built-in high-velocity fan that provides optimum cooling. Two optional replacement fan blades are available for special cooling requirements. Crown part C 6594-3 is a quieter, low-velocity fan blade that in many cases can provide adequate cooling. Crown part C 6593-5 is a reverse air flow fan blade which changes the direction of the air flow in and out of the amplifier (not recommended for the *Micro-Tech 2400*). **Important: The optional replacement fan blades should only be installed by a qualified technician.**

## 8.2 Input Connectors

There are two input connector accessories available at the time of this printing: the *MT-XLR* and the *MT-BB*. **Important: The *MT-XLR* and *MT-BB* must be installed at an authorized service center or the Crown factory.**

### 8.2.1 MT-XLR

The *MT-XLR* is an accessory panel that provides two standard 3-pin female XLR input connectors. The *MT-XLR* accessory makes it easy to quickly change connections in a system that uses standard XLR connectors. It can also be used in systems that need to daisy chain an input signal from one amplifier to another. Because the *MT-XLR* connectors are in parallel with the amplifier's built in phone connectors, an input signal fed to either input can be fed to another amplifier from the unused connector for that channel.

### 8.2.2 MT-BB

The *MT-BB* is an accessory panel that provides barrier strip input connectors. An *MT-BB* accessory might be desirable in applications requiring bare wire connections. It can also be used to daisy chain an input signal from one amplifier to another just like the *MT-XLR*.

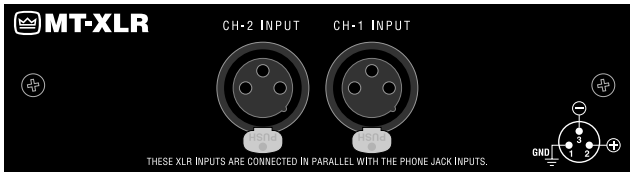



*Fig. 8.1 MT-XLR*

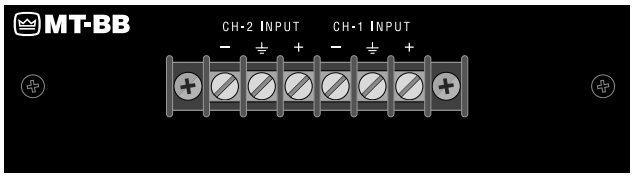



*Fig. 8.2 MT-BB*

# 9 Service

This unit has very sophisticated circuitry which should only be serviced by a fully trained technician. This is one reason why each unit bears the following label:

**CAUTION: To prevent electric shock, do not remove covers. No user serviceable parts inside. Refer servicing to a qualified technician.**

## 6.1 Worldwide Service

Service may be obtained from an authorized service center. (Contact your local Crown/Amcron representative or our office for a list of authorized service centers.) To obtain service, simply present the bill of sale as proof of purchase along with the defective unit to an authorized service center. They will handle the necessary paperwork and repair.

Remember to transport your unit in the original factory pack.

## 6.2 North American Service

Service may be obtained in one of two ways: from an authorized service center or from the factory. You may choose either. It is important that you have your copy of the bill of sale as your proof of purchase.

### 6.2.1 Service at a North American Service Center

This method usually saves the most time and effort. Simply present your bill of sale along with the defective unit to an authorized service center to obtain service. They will handle the necessary paperwork and repair. Remember to transport the unit in the original factory pack. A list of authorized service centers in your area can be obtained from our Technical Support Group.

### 6.2.2 Factory Service

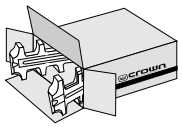
To obtain factory service, fill out the **service information page** found in the back of this manual and send it along with your proof of purchase and the defective unit to the Crown factory.

For warranty service, we will pay for ground shipping both ways in the United States. Contact Crown Factory Service or Technical Support to obtain prepaid shipping labels prior to sending the unit. Or, if you prefer, you may prepay the cost of shipping, and Crown will reimburse you. Send copies of the shipping receipts to Crown to receive reimbursement.

Your repaired unit will be returned via UPS ground. Please contact us if other arrangements are required.

**Factory Service Shipping Instructions:**

1. When sending a Crown product to the factory for service, be sure to fill out the service information form that follows and enclose it inside your unit's shipping pack. Do not send the service information form separately.



**Always use the original factory pack to transport the unit.**

2. To ensure the safe transportation of your unit to the factory, ship it in an original factory packing container. If you don't have one, call or write Crown's Parts Department. With the exception of polyurethane or wooden crates, any other packing material will not be sufficient to withstand the stress of shipping. **Do not use loose, small size packing materials.**
3. Do not ship the unit in any kind of cabinet (wood or metal). Ignoring this warning may result in extensive damage to the unit and the cabinet. Accessories are not needed—do not send the product documentation, cables and other hardware.

If you have any questions, please call or write the Crown Technical Support Group.

**Crown Customer Service**
Technical Support / Factory Service
Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

*Telephone:* 219-294-8200
800-342-6939 (North America, Puerto Rico, and Virgin Islands only)
*Facsimile:* 219-294-8301 (Technical Support)
219-294-8124 (Factory Service)
*Internet:* http://www.crownaudio.com
*Email:* technicalsupport@crownintl.com

# Crown Factory Service Information

Shipping Address: Crown Audio, Inc., Factory Service, Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, IN 46517
Phone: 1-800-342-6939 or 1-219-294-8200 Fax: 1-219-294-8124

**Owner's Name:** _____

**Shipping Address:** _____

**Phone Number:** _____ **Fax Number:** _____

**Model:** _____ **Serial Number:** _____ **Purchase Date:** _____

## NATURE OF PROBLEM

*(Be sure to describe the conditions that existed when the problem occurred and what attempts were made to correct it.)*

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

**Other equipment in your system:** _____

_____

_____

_____

_____

_____

_____

**If warranty has expired, payment will be:** ❑ **Cash/Check** ❑ **VISA** ❑ **MasterCard** ❑ **C.O.D.**

**Card Number:** _____ **Exp. Date:** _____ **Signature:** _____

**ENCLOSE THIS PORTION WITH THE UNIT. DO NOT MAIL SEPARATELY.**

Detach and send with unit.